



This is a digital copy of a book that was preserved for generations on library shelves before it was carefully scanned by Google as part of a project to make the world's books discoverable online.

It has survived long enough for the copyright to expire and the book to enter the public domain. A public domain book is one that was never subject to copyright or whose legal copyright term has expired. Whether a book is in the public domain may vary country to country. Public domain books are our gateways to the past, representing a wealth of history, culture and knowledge that's often difficult to discover.

Marks, notations and other marginalia present in the original volume will appear in this file - a reminder of this book's long journey from the publisher to a library and finally to you.

Usage guidelines

Google is proud to partner with libraries to digitize public domain materials and make them widely accessible. Public domain books belong to the public and we are merely their custodians. Nevertheless, this work is expensive, so in order to keep providing this resource, we have taken steps to prevent abuse by commercial parties, including placing technical restrictions on automated querying.

We also ask that you:

- + *Make non-commercial use of the files* We designed Google Book Search for use by individuals, and we request that you use these files for personal, non-commercial purposes.
- + *Refrain from automated querying* Do not send automated queries of any sort to Google's system: If you are conducting research on machine translation, optical character recognition or other areas where access to a large amount of text is helpful, please contact us. We encourage the use of public domain materials for these purposes and may be able to help.
- + *Maintain attribution* The Google "watermark" you see on each file is essential for informing people about this project and helping them find additional materials through Google Book Search. Please do not remove it.
- + *Keep it legal* Whatever your use, remember that you are responsible for ensuring that what you are doing is legal. Do not assume that just because we believe a book is in the public domain for users in the United States, that the work is also in the public domain for users in other countries. Whether a book is still in copyright varies from country to country, and we can't offer guidance on whether any specific use of any specific book is allowed. Please do not assume that a book's appearance in Google Book Search means it can be used in any manner anywhere in the world. Copyright infringement liability can be quite severe.

About Google Book Search

Google's mission is to organize the world's information and to make it universally accessible and useful. Google Book Search helps readers discover the world's books while helping authors and publishers reach new audiences. You can search through the full text of this book on the web at <http://books.google.com/>



TN
808
G6C48

MEMOIRS OF THE GEOLOGICAL SURVEY,
SCOTLAND.

THE ECONOMIC GEOLOGY
OF
THE CENTRAL COALFIELD OF
SCOTLAND,
DESCRIPTION OF AREA VII.



INCLUDING THE DISTRICTS OF
RUTHERGLEN, HAMILTON, AND WISHAW.

BY

THE LATE C. T. CLOUGH, M.A., LL.D.; THE LATE J. S. G. WILSON;
E. M. ANDERSON, M.A., B.Sc.; and M. MACGREGOR, M.A., B.Sc.,

WITH CONTRIBUTIONS BY

R. G. CARRUTHERS and C. H. DINHAM, B.A.

PUBLISHED BY ORDER OF THE LORDS COMMISSIONERS OF HIS MAJESTY'S TREASURY.



EDINBURGH:
PRINTED UNDER THE AUTHORITY OF HIS MAJESTY'S
STATIONERY OFFICE
By MORRISON & GIBB, LIMITED, TANFIELD.

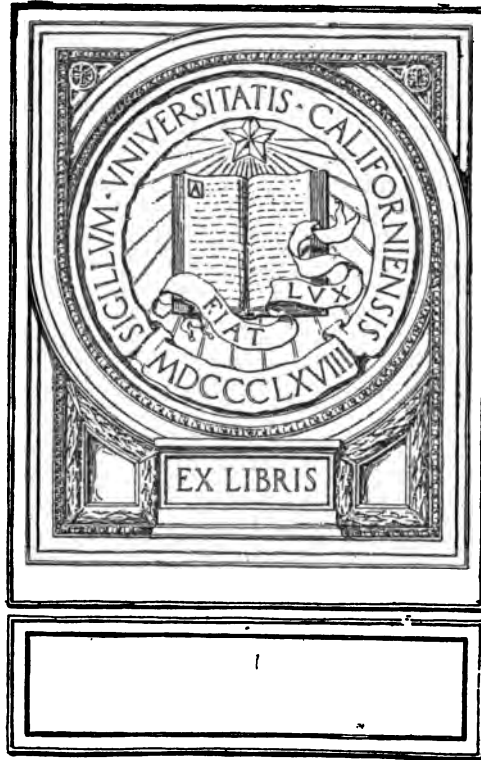
And to be purchased from
E. STANFORD, LTD., 12, 13 and 14 LONG ACRE, LONDON, W.C.2;
W. & A. K. JOHNSTON, LIMITED, 2 ST. ANDREW SQUARE, EDINBURGH;
HODGES, FIGGIS & CO., LIMITED, 104 GRAFTON STREET, DUBLIN.
From any Agent for the sale of Ordnance Survey Maps,
or through any Bookseller, or from the Director-General, Ordnance Survey
Office, Southampton.

1920.

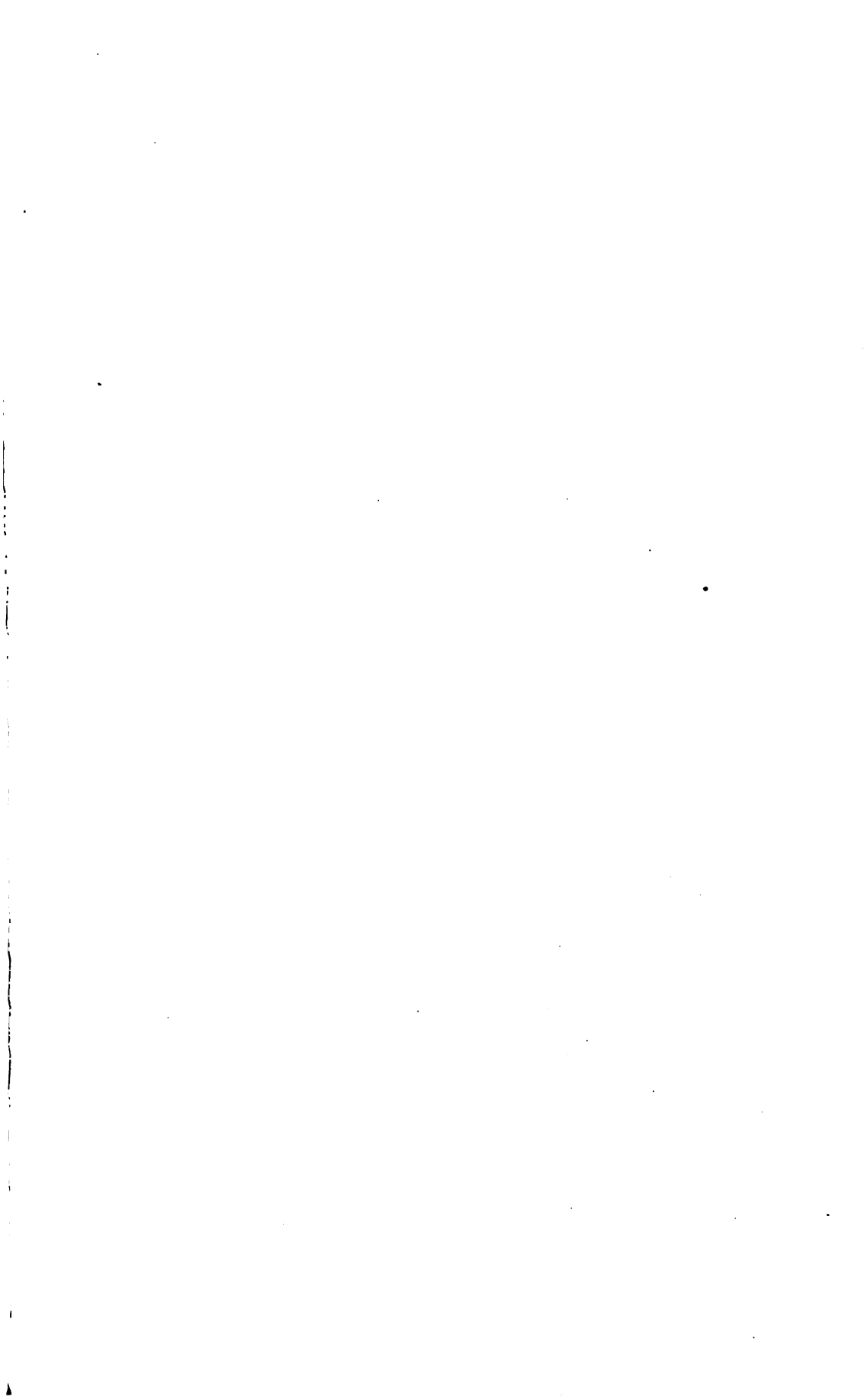
Price Seven Shillings and Sixpence Net.

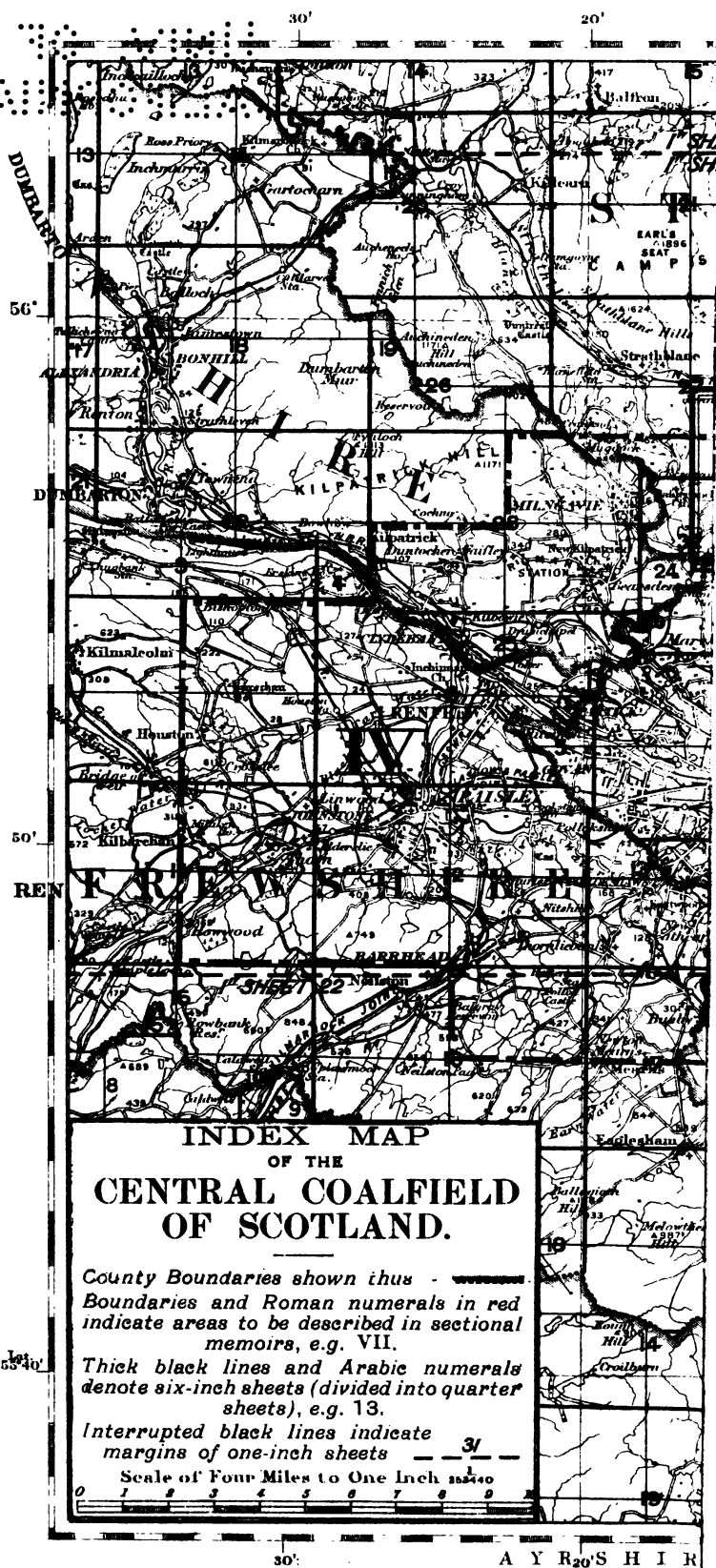
YC 18822

EXCHANGE









MEMOIRS OF THE GEOLOGICAL SURVEY,
SCOTLAND.

THE ECONOMIC GEOLOGY
OF
THE CENTRAL COALFIELD OF
SCOTLAND,

DESCRIPTION OF AREA VII.

*INCLUDING THE DISTRICTS OF
RUTHERGLEN, HAMILTON, AND WISHAW.*

BY

THE LATE C. T. CLOUGH, M.A., LL.D.; THE LATE J. S. G. WILSON;
E. M. ANDERSON, M.A., B.Sc.; and M. MACGREGOR, M.A., B.Sc.,

WITH CONTRIBUTIONS BY

R. G. CARRUTHERS and C. H. DINHAM, B.A.

PUBLISHED BY ORDER OF THE LORDS COMMISSIONERS OF HIS MAJESTY'S TREASURY.

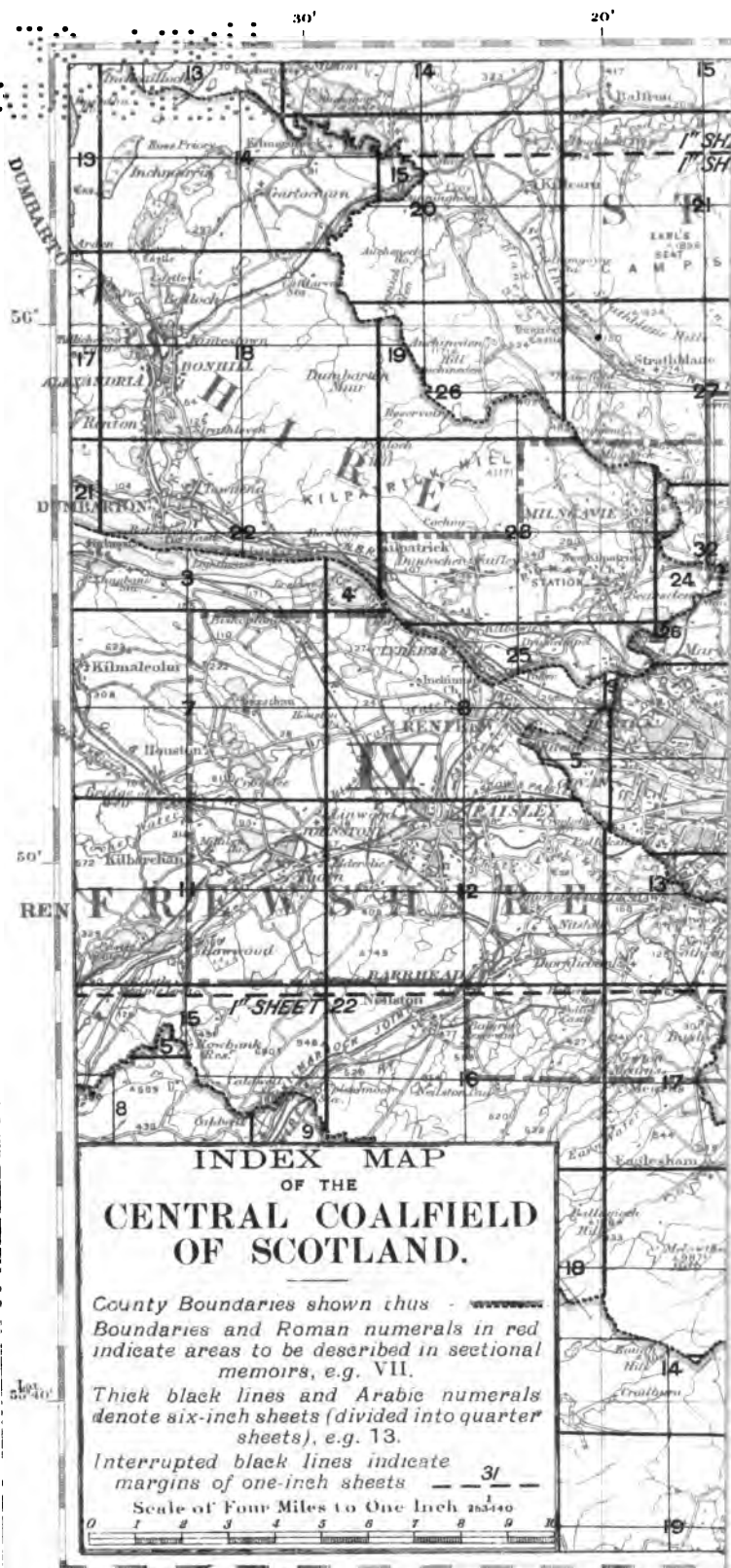


EDINBURGH:
PRINTED UNDER THE AUTHORITY OF HIS MAJESTY'S
STATIONERY OFFICE
By MORRISON & GIBB, LIMITED, TAYFELD

And to be purchased from
E. STANFORD, LTD., 12, 13 and 14 LONG ACRE, LONDON, W.C.2;
W. & A. K. JOHNSTON, LIMITED, 2 ST. ANDREW SQUARE, EDINBURGH;
HODGES, FIGGIS & CO., LIMITED, 194 GRAFTON STREET, DUBLIN.
From any Agent for the sale of Ordnance Survey Maps,
or through any Bookseller, or from the Director-General, Ordnance Survey
Office, Southampton.

1926

Price Seven Shillings and Sixpence Net.



MEMOIRS OF THE GEOLOGICAL SURVEY,
SCOTLAND.

THE ECONOMIC GEOLOGY
OF
THE CENTRAL COALFIELD OF
SCOTLAND,

DESCRIPTION OF AREA VII.

*INCLUDING THE DISTRICTS OF
RUTHERGLEN, HAMILTON, AND WISHAW.*

BY

THE LATE C. T. CLOUGH, M.A., LL.D.; THE LATE J. S. G. WILSON;
E. M. ANDERSON, M.A., B.Sc.; and M. MACGREGOR, M.A., B.Sc.,

WITH CONTRIBUTIONS BY

R. G. CARRUTHERS and C. H. DINHAM, B.A.

PUBLISHED BY ORDER OF THE LORDS COMMISSIONERS OF HIS MAJESTY'S TREASURY.



EDINBURGH:
PRINTED UNDER THE AUTHORITY OF HIS MAJESTY'S
STATIONERY OFFICE
By MORRISON & GIBB, LIMITED, TANFIELD.

And to be purchased from
E. STANFORD, LTD., 12, 13 and 14 LONG ACRE, LONDON, W.C. 2;
W. & A. K. JOHNSTON, LIMITED, 2 ST. ANDREW SQUARE, EDINBURGH;
HODGES, FIGGIS & CO., LIMITED, 104 GRAFTON STREET, DUBLIN.
From any Agent for the sale of Ordnance Survey Maps,
or through any Bookseller, or from the Director-General, Ordnance Survey
Office, Southampton.

1920:

Price Seven Shillings and Sixpence Net.

TN 808
G 6 C 48

PREFACE.

THE district described in this Memoir forms the seventh of the areas into which the Central Coalfield of Scotland has been divided for the purpose of describing the economic geology. It lies almost wholly within Lanarkshire, and includes some of the most important mining ground in that county. The original geological survey was made as regards the western part by Hull, and as regards the remainder by J. Geikie. The six-inch geological maps were published in 1870 and 1874; the one-inch maps, Sheets 23 and 31, in 1872 and 1875 respectively. The Explanations of these two sheets appeared in 1873 and 1879.

The revision of the area was completed in 1914, the work being distributed as follows:—Rutherglen District, Mr. R. G. Carruthers; District of Uddingston and Bothwell, the late Mr. J. S. G. Wilson; Mossend and Motherwell District, the late Dr. C. T. Clough; District of Cleland and Newarthill, Mr. E. M. Anderson; Hamilton District, Mr. M. Macgregor and Mr. C. H. Dinham; Wishaw District, Mr. Macgregor.

The general results of the revision of the western part of Area VII. are incorporated in "The Geology of the Glasgow District," which was published, along with a one-inch map of the district, in 1911, but the publication of the majority of the revised six-inch quarter sheets has been delayed for reasons connected with the War.

The editing of the Memoir had been entrusted to the late Dr. C. T. Clough, and was well in hand at the time of his death. It has been completed by Mr. Anderson.

Our thanks are due to many proprietors, to mining companies, mining engineers, and colliery managers, for information furnished during the revision, and now in part reproduced.

A. STRAHAN,
Director.

GEOLOGICAL SURVEY OFFICE,
28 JERMYN STREET,
LONDON, S.W. 1, 5th May 1919.

TO THE
LIBRARY OF THE
GEOLOGICAL SURVEY

CONTENTS.

CHAPTER I.

	PAGE
INTRODUCTION	1
Area under Description	1
General Structure	3
Mining History	5
Acknowledgments	6

CHAPTER II.

LOWER PART OF CARBONIFEROUS SEQUENCE	7
A. CALCIFEROUS SANDSTONE SERIES	7
B. CARBONIFEROUS LIMESTONE SERIES	7
Aikenhead	8
West of High Blantyre	8
"New Ironstone"	8
Extension of Limestone Coal Group beneath Coal Measures of the Area	9
Muirhouse Bore	9
Factors in Future Boring	11
C. MILLSTONE GRIT	11
Goodockhill	11
Goodockhill Slatyband Ironstone	12
Hareshaw Fireclay	13
Govan Colliery Bore	13

CHAPTER III.

COAL MEASURES, RUTHERGLEN TO BOTHWELL	15
A. RUTHERGLEN DISTRICT	15
Kiltongue Coal	16
Virtuewell Coal	17
Musselband Coal	17
Splint Coal	17
Upper Coal	18
"Wants"	18
Barren Measures	18

	PAGE
B. UDDINGSTON AND BOTHWELL DISTRICT	19
Strata below the Balmoral Coal	20
Balmoral Coal	21
Lower Drumgray Coal	21
Upper Drumgray Coal	23
Kiltongue Coal	24
Kiltongue Musselband	25
Virtuewell Coal	26
Blackband Coal	27
Musselband Coal	29
Splint and Virgin Coals	29
Humph Coal	33
Main and Pyotshaw Coals	34
Cambuslang Marble	36
Ell Coal	36
Strata between Ell and Upper Coals	38
Upper Coal	39
Barren Measures	41
General Structure	43
Faults	43
Whinstone Dykes	44
Possible Reserves of Coal	44

CHAPTER IV.

COAL MEASURES, MOSSEND, MOTHERWELL, CLELAND, AND NEWARTHILL	46
A. DISTRICT OF MOSSEND AND MOTHERWELL	46
Balmoral Coal and underlying Strata	47
Shotts Gas Coal	48
Lower Drumgray Coal	48
Upper Drumgray Coal	50
Kiltongue Coal and Kennelburn Ironstone	52
Kiltongue Musselband Shale and Ironstone	53
Ladygrange Coal	54
Virtuewell Coal	54
Blackband Coal	56
Musselband Coal and Musselband Ironstone	57
Splint and Virgin Coals	58
Humph Coal	60
Main and Pyotshaw Coals	61
Ell Coal	62
Upper Coal and Palacecraig Blackband Ironstone	64
Higher Seams	65
Skipsey's Marine Band	66
Barren Measures	67
General Structure	68
Faults	68
Whinstone Dyke	70
Buried River Channel	70

V

	PAGE
B. DISTRICT OF CLELAND AND NEWARTHILL	70
Crofthead Coal	72
Clefted or Balmoral Coal.	72
Shotts Gas Coal	72
Lower Drumgray Coal	73
Mid Drumgray Coal	73
Upper Drumgray Coal	74
Kiltongue Coal	75
Kiltongue Musselband Shale and Ironstone	75
Ladygrange Coal	75
Bellside Ironstone	76
Virtuewell Coal	76
Roughband Ironstone	77
Airdrie Blackband Ironstone	77
Blackband Coal	77
Musselband Coal	79
Virgin Coal	79
Splint Coal	79
Humph Coal	79
Main and Pyotshaw Coals	80
Ell Coal	81
Seams above the Ell Coal	81
Structural Features	82
Intrusive Dolerite	82
Buried River Channels	83
Future Development of the District	83

CHAPTER V.

COAL MEASURES, HAMILTON AND WISHAW	85
A. HAMILTON DISTRICT.	85
Base of Coal Measures to Lower Drumgray Coal	86
Kiltongue—Drumgray Coal Group	87
Lower Drumgray Coal	88
“Lower Drumgray” of Allanton, etc.	89
Upper Drumgray (“Kiltongue” Coal of Hamilton)	90
Kiltongue Coal of Earnock	91
Kiltongue Coal	91
Kiltongue Musselband	91
Virtuewell Coal	92
Roughband Ironstone	93
Blackband Coal	93
Splint and Virgin Coals	94
Humph Coal	95
Main Coal	96
Pyotshaw Coal	97
Ell Coal	98
Strata above the Ell Coal	99
Avonbrae Coal Group	100

	PAGE
A. HAMILTON DISTRICT—<i>continued</i>—	
Skipsey's Marine Band	100
Barren Measures	100
Structural Features	101
Buried Channels of Clyde and Avon	102
Reserves of Coal	102
B. WISHAW DISTRICT	103
Armadale Coal Group	105
Shotts Gas Coal	106
Lower Drumgray (Smithy) Coal	106
Mid Drumgray Coal	107
Upper Drumgray Coal	108
Kiltongue Coal	108
Bellside Ironstone	110
Virtuewell Coal	110
Roughband Ironstone	112
Blackband Coal	112
Musselband Coal	113
Splint and Virgin Coals	113
Main and Pyotshaw Coals	115
Ell Coal	117
Strata between Ell Coal and Skipsey's Marine Band	118
"Upper Coal"	119
Skipsey's Marine Band	120
Calcareous "burning" of Coals	120
Structural Features	121
Buried River Channels	122
Reserves of Coal	122

CHAPTER VI.

SANDSTONE QUARRIES	124
Auchinlea Quarries	124
Bothwell Park Quarries	125
Former Sources of Sandstone	126

CHAPTER VII.

SUPERFICIAL DEPOSITS	130
Introduction	130
Sands and Gravels older than the Boulder-clay	130
Boulder-clay	131
Sands, Gravels, and Brick-clays overlying the Boulder-clay	132
Buried Channels of the Clyde and Avon	133
Deposits of 100-foot Terrace	134
Polmadie Brick-clay	134
Recent Deposits	134

APPENDIX.

Glossary of Scottish Mining Terms used in this Memoir	PAGE
	135
INDEX	137

FIGURES IN TEXT.

FIG. 1. Index Map of Area VII., showing six-inch Quarter Sheets and principal geological formations	2
„ 2. Horizontal Section from Dechmont Hill to Calderbank	4
„ 3. Horizontal Section from Motherwell to Woodhall	68
„ 4. “Wants” in successive Coal Seams adjacent to a Fault, Spindleside Pit, Cleland	82

PLATES.

PLATE I. Index Map of the Central Coalfield of Scotland	<i>Frontispiece</i>
„ II. Sections of Strata above the Splint Coal ; Districts of Rutherglen, Uddingston, and Bothwell	} In pocket at end of Volume.
„ III. Sections of Strata below the Splint Coal, mainly in Districts of Rutherglen, Uddingston, and Bothwell	
„ IV. Sections of Strata above the Splint Coal ; District of Mossend and Motherwell	
„ V. Sections of Strata below the Splint Coal ; District of Mossend and Motherwell	
„ VI. Sections of Strata, mainly in Districts of Hamilton and Wishaw	

THE ECONOMIC GEOLOGY OF THE CENTRAL COALFIELD OF SCOTLAND.

AREA VII.

CHAPTER I.

INTRODUCTION.

THE area under description extends from Rutherglen to Newmains, including Cambuslang, Uddingston and Bothwell, Hamilton, Motherwell, and Wishaw. The six-inch maps are as follows:—

Lanark, 10 N.E.; 11 N.W., S.W., N.E., S.E.; 12 N.W., S.W., N.E., S.E.;
17 N.E.; 18 N.W., N.E.
Renfrew, 13 N.E.; 13 S.E. (in part).

The frontispiece shows the areas into which the Central Coalfield is being divided for purposes of description, and also indicates the boundaries and distinctive numbers of the new series geological six-inch quarter sheets.

In Fig. 1 the area described in this Memoir is illustrated on a somewhat larger scale. The new series quarter sheets showing the revised survey are now in course of publication (*see* advertisement). For the original mapping the reader may be referred to the old series geological six-inch Maps, Lanark 11, 12, 17, and 18, and Renfrew 13, but these, of course, do not show the results of the recent revision. Alterations and additions have in many cases been extensive, and it should be noted that access to the revised manuscript maps may usually be had during office hours at the Geological Survey Office, 33 George Square, Edinburgh. Renfrew 13 N.E., will not be published separately, as the small area comprised is all included in Lanark 10 N.E. Similarly Renfrew 13 S.E., will not be published as a geological map, as it does not contain much of economic importance, and is partly included in Lanark 10 N.W. and N.E. It should be mentioned that these new series geological maps are published in three different forms—one uncoloured; another coloured to show the solid rocks and alluvia, but not the other superficial deposits, such as boulder clay and glacial sand; and a third in which these

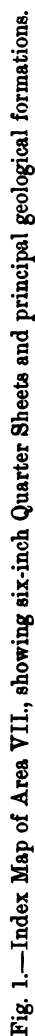


Fig. 1.—Index Map of Area VII., showing six-inch Quarter Sheets and principal geological formations.

surface deposits are all shown by colour. The last form may be useful to water engineers and local sanitary authorities, as well as to those interested in the surface deposits for their own sake, but will not as a rule be desired by those engaged in mining.

The mining of coal and ironstone is fully treated in Chapters III. to V. of this Memoir, which deal with the Coal Measure seams, while some account of the condition of those in the Carboniferous Limestone Series is given in Chapter II. Various references to fireclay will also be found in these chapters. Sandstone quarrying is treated separately in Chapter VI. Whinstone quarrying is practically non-existent, though some disused quarries are mentioned in Chapter II., and others in Chapter IV. The making of composition brick is mentioned incidentally in different chapters, while brickmaking from surface clay is treated in the chapter on superficial deposits (Chapter VII.).

The Index Map (Fig. 1) also shows the surface distribution of the four divisions of Carboniferous rocks, which together occupy the whole of the present area. These are in descending order:—

Coal Measures.
Millstone Grit.
Carboniferous Limestone Series.
Calciferous Sandstone Series.

The Calciferous Sandstone Series is divided in the map into lavas (whinstone) and overlying sediments. Similarly the Coal Measures are divided into Productive Measures, and the overlying Barren or Red Measures.

The lava flows of Calciferous Sandstone age are the oldest rocks exposed in the area. They form part of the Cathkin Hills, which may be regarded as an elevated fault-block, since it is bounded on almost every side by faults.

The Carboniferous Limestone Series is subdivided into three groups, not shown separately on the Index Map, viz.:—

Upper Limestone Group.
Limestone Coal Group.
Lower Limestone Group.

These will be shown by separate colours on one-inch sheets 23 and 31 which still remain to be published. In the same way the Productive Coal Measures have been divided into two subordinate groups, the line of division being the Splint Coal. This subdivision has been shown by difference of colour in the geological one-inch map of the Glasgow District.

The division line between the Lower or Productive, and the Upper, Red, or Barren Coal Measures has been drawn at a thin limestone with marine fossils, known as Skipsey's Marine Band, which is at a height of 55 fathoms above the Ell Coal near Motherwell. The total thickness of Productive Measures shows a steady increase from west to east, rising from about 140 fathoms near Rutherglen to approximately 200 fathoms to the east of Wishaw.

The Coal Measures within the area may be regarded as forming part of a deep basin striking roughly north-west, with its centre not

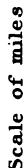


Fig. 2.—Horizontal Section from Dechmont Hill to Calderbank.

far from Uddingston. But the basin is by no means regular. It is limited on the south-west side by a huge dislocation known as the Dechmont Fault, which between High Blantyre and Dechmont brings the Red or Barren Measures against different parts of the Calciferous Sandstone Series. The whole of the Productive Measures, the Millstone Grit, and the Carboniferous Limestone Series are thus cut out by a throw which must in this neighbourhood be about 600 fathoms. The general direction of the fault is north-west and south-east, and it can be traced for some miles in both directions beyond the present area.

The dip towards the centre of the basin is usually rather gentle, rarely exceeding 1 in 4 or 5. The effect is sometimes balanced by contrary faulting. Fig. 2 shows a transverse section across the deepest part of the basin, while Fig. 3 (p. 68) shows the alternate influence of dips and faults in a more outlying part.

With one trifling exception the Calciferous Sandstone and Carboniferous Limestone Series come to the surface in this area only to the south-west of the Dechmont Fault. The Millstone Grit is limited to a narrow axis which crosses the north-eastern corner of the area.

The main faults in this, as in other parts of the Central Coalfield, have a tendency to run in two separate directions, which approximate to east and west, and to south-east and north-west. An example mainly of the latter type is the Dechmont Fault; many of both classes will be noted in considering the detailed structure of the area.

The only dyke-intrusions known, with one exception, run parallel to the system of north-westerly faults. Whin "floats" are fortunately almost absent, but one occurs between the Main and Splint Coals in the district to the east of Newarthill.

This area is perhaps at present the most important mining district in Lanarkshire, and it may be of interest to say a word or two about its historical development. Owing to the depth at which they were buried, the Uddingston Basin held a reserve of the Ell, Main, and Splint Coals, when these seams were approaching exhaustion in the surrounding districts. In "A New Geological Map of Scotland," published by Macculloch in 1840, the Red or Barren Measures which occupy the centre of the basin were shown as belonging to the underlying Old Red Sandstone. This opinion, if shared by the mining community, would no doubt have had a deterrent effect on mining operations. Already in 1836, however, the Rev. William Patrick had come to the conclusion that the Red Measures overlay the coals,¹ and both he, and later Craig,² classed these deposits as "Upper Red Sandstone," *i.e.* Permian or Triassic. Nicol³ more correctly states that "they are truly a portion of the coal formation."

At what date the coals came to be worked below the Red Measures is unknown to the writer, but Dron⁴ says that "Most of the collieries in the deeper portion of the field, from Cambuslang to Hamilton, have been opened up since the year 1870, the development of the district being very much stimulated by the introduction of the Bothwell and Hamilton Railway in 1876-7."

The importance of the Uddingston Basin was largely due to the reserve of coal alluded to, and it is only during the last few years that the Ell, Main, and Splint Coals in the deeper part have begun to show signs of exhaustion. None of the underlying coals, from the Blackband to the Lower Drumgray, are persistent in thickness over the area as a whole. There are, however, many square miles in each case of workable coal. The still lower group of Armadale Coals is hardly represented in the present area. They suffer a progressive thinning when traced from east to west, and the only member which can be recognised over any large part of the district is the uppermost—the Mill or Balmoral Coal.

It is thus probable that while the output from this district may be maintained for a good many years, it will not be largely increased. The output for Lanarkshire as a whole attained in 1907 the maximum figure of 17,968,298 tons, and had diminished to 17,486,247 tons in 1913.⁵ In 1897 this county furnished more than half the total output for Scotland. In 1907 the proportion was 45, and in 1913 only 41 per cent.

In addition to the authorities already quoted, numerous references

¹ New Statistical Account of Scotland, vol. vi., 1845, p. 772.

² "On the Carboniferous Formation of the Lower Ward of Lanarkshire." *Trans. Highland and Agric. Soc.*, vol. vi., 1839, p. 341.

³ "Geology of Scotland," 1844, p. 101.

⁴ "The Coalfields of Scotland," 1902, p. 91

⁵ "Mines and Quarries. General Report with Statistics." Part III. Output (*Home Office Reports*). For years mentioned.

to the geology and mining activity of the district will be found in the various volumes of "Transactions of the Glasgow Geological Society," "Transactions of the Institute of Mining Engineers," and other publications. All information of importance referring to the area other than such as is purely scientific from "Explanation of Sheet 31"¹ and "The Geology of the Glasgow District"² has been reproduced in the present Memoir.

In a district where mining is active any published map of the mineral field is liable to get quickly out of date. In some cases fresh knowledge has been acquired since the publication of the new series maps concerned, and this fresh knowledge has been partly incorporated in the following pages.

Neither the maps nor the Memoir could have been completed without the help of the mining community interested in the area. The solid rocks are for the most part deeply buried under superficial deposits, so that the crops of the various seams, and the faults that intersect them, have necessarily to a large extent to be drawn from mining evidence. To all those proprietors, colliery managers, or mining engineers, who have placed their information at our disposal, we are greatly indebted. It is hardly possible to mention in detail the assistance that has been received.

Permission has been generously given to publish in graphic form the journals of various bores and pit sections. For convenience these are printed on separate slips (Plates II. to VI.) which fold into the pocket at the end of this Memoir. They will be frequently referred to in the course of the following chapters.

C. T. C., E. M. A.

¹ *Mem. Geol. Surv.*, 1879.

² *Mem. Geol. Surv.*, 1911.

CHAPTER II.

LOWER PART OF CARBONIFEROUS SEQUENCE.

THIS chapter includes a description of those parts of the Carboniferous System which underlie the base of the Coal Measures. From this point downwards they are as follows :—

- C. Millstone Grit.
- B. Carboniferous Limestone Series (including the Limestone Coal Group).
- A. Calciferous Sandstone Series.

A. CALCIFEROUS SANDSTONE SERIES.

The upper part of this series consists of an underlying group of volcanic origin, mainly lavas, and an overlying group of sediments. Along with the Carboniferous Limestone Series the two groups occupy the whole of that part of the area to the south-west of the Dechmont Fault. The volcanic group is bounded to the north and east by this dislocation, its southern boundary being also in part a downthrow fault. From their resistance to atmospheric denudation, these rocks have formed the relatively high ground of the Cathkin Hills. They consist mainly of basaltic lavas, which may be divided into an underlying non-porphyrific, and an overlying porphyritic sequence. The former have not been quarried to any considerable extent. There are abandoned quarries in the upper group near Greenleeshill, and to the east of Dechmont Hill. These were wrought presumably for road metal; the former is in a basalt of Dunsapie type, similar to that which was quarried on a rather larger scale to the south of Cathkin Braes public park.

The lavas are separated by thin bands of ash and sediment, which are often water-bearing. Outside the area the water so supplied has been used locally. Owing to the comparatively sparse population, the Cathkin Hills have a more important function as a "catchment area" for water. Turnlaw and Cocksburn Reservoirs lie among the lavas and within the limits of Area VII. They form a part of the water-supply of Cambuslang.

The overlying sediments include sandstones, one of which has been locally quarried. At their base occurs a peculiar bed of whitish mudstone. They are exposed at the surface to the west of High Blantyre, on the upthrow side of the Dechmont Fault. E. M. A.

B. CARBONIFEROUS LIMESTONE SERIES.

This series is subdivided as follows :—

- Upper Limestone Group.
- Limestone Coal Group.
- Lower Limestone Group.

In Scotland as a whole the Limestone Coal Group ranks next to the Productive Coal Measures in economic importance, while the Upper and Lower Limestone Groups also contain valuable seams.

Strata included in the middle group come to the surface south-west of Rutherglen, between two branches of the Dechmont Fault, which splits at a point to the south of Burnside into branches running west and north-west respectively.¹ Our knowledge of the sequence here is derived mainly from No. 4 bore Aikenhead, which was put down 160 yards north-east of Aikenhead House. Near the surface this bore passed through a "whinstone float" 40 fathoms in thickness, and a short distance below this ten coal seams belonging to the Possil Series were encountered. The seams could not however be individually named, and none of them exceeded 18 inches in thickness. At a lower horizon the bore passed through the Black Metals, or Logan's Bands position, in which one clayband ironstone was found measuring 7 inches, and another 11 inches in thickness. The Lower Garscadden or Govan Blackband Ironstone was represented by a 16-inch coal, and finally the Kilsyth Coking Coal, or a member of the group to which it belongs, was proved with a thickness of 17 inches.

An outcrop of dolerite, apparently corresponding to the "float" already mentioned, is seen north-east of Castlemilk, and is overlain by "burnt" sediments.

R. G. C.

The Lower Limestone Group is brought to the surface by the Dechmont Fault south-west of High Blantyre. The "New Ironstone" was wrought to a small extent on the southern margin of Lanark, 11 S.W., the section being as follows:—

	Ft.	In.
Blaes roof		
IRONSTONE	0	5½
COAL	0	8
Dark blaes (holing in lower half)	1	3
IRONSTONE	0	11½
Blaes pavement		

This seam lies about 7 fathoms above the Main or Hurlet Limestone, and about 4 fathoms below the Wee Post Limestone, which is equivalent to the Foul Hosie Limestone of Carluke. The ironstones thus correspond in position to the Househill Claybands of Nitshill and Hurlet, and the coal to the Smithy Coal of Wilsontown. The heap of blaes which was formed while mining was in progress, was utilised, at a later date, for making composition brick.

A triangular area occupied in part by the Limestone Coal Group and in part by Upper Limestone strata, is included in Lanark 17 N.E., being bounded on the north-eastern side by the Dechmont Fault. No coal or ironstone appears to have been wrought within the area, although the old Crutherland Coal workings are only two or three miles to the west.² Their position would be reached about 40 fathoms below the Index Limestone, which was worked in an old quarry just south of Dike-end. A blackband ironstone forming a member of the

¹ "The Geology of the Glasgow District" (*Mem. Geol. Surv.*), 1911, p. 170.

² See "Econ. Geol. Central Coalfield, Area VIII," (*Mem. Geol. Surv.*), 1917, pp. 22 et seq.

same group was wrought a short distance to the south at Earnock-muir.

Although only an unimportant part of the area described in this Memoir is occupied by rocks of Carboniferous Limestone age, their underground extension beneath the Coal Measures is not open to doubt. It is thus of interest to consider the probability of their containing workable seams.

The rather poor development of the Limestone Coal Group near Rutherglen, and the fact that the Cruthersland seams are nowhere of any great thickness, would tend to discourage boring for coal beneath the base of the Coal Measures in the western and south-western parts of the area. In the deepest part of the Uddington Basin the Index Limestone is probably at a depth of 500 fathoms, and we have no evidence of any thickness of coal below it which would justify even putting a bore to such a depth.

The most important direct evidence in the north-eastern part of the area is the deep Muirhouse bore, situated close to the Tillan Burn, on the eastern margin of Lanark 12 N.E. Reference will be made in a future paragraph to the record obtained in the Millstone Grit. The following are the main items in the part of the bore which lies beneath (*see* Plate V., Section 5).

	Thickness.			Depth.		
	Fms.	Ft.	In.	Fms.	Ft.	In.
BASE OF MILLSTONE GRIT	.	.	.	52	0	0
Strata	.	.	.	.	.	.
CALMY LIMESTONE .	0	4	7	91	0	0
Strata	.	.	.	.	.	.
HIRST COAL .	0	2	4	93	0	0
Strata	.	.	.	.	.	.
ORCHARD LIMESTONE	0	1	9	116	0	0
Strata	.	.	.	.	.	.
COAL .	0	2	4	147	0	0
Strata	.	.	.	.	.	.
INDEX LIMESTONE .	1	0	5	163	0	0
Strata	.	.	.	.	.	.
COAL .	0	1	0	175	0	0
Strata	.	.	.	.	.	.
BLACKBAND IRONSTONE	0	0	7	181	0	0
Strata	.	.	.	.	.	.
COAL .	0	1	1	184	0	0
Fireclay .	0	0	2½			
COAL .	0	0	7			
Coaly Fireclay .	0	0	0½			
COAL .	0	0	7½			
Blaes .	0	1	5			
COAL .	0	0	7½			
Strata	.	.	.	.	.	.
COAL .	0	1	0	193	0	0
Hard faky fireclay .	0	1	4			
COAL .	0	1	1½			
Strata	.	.	.	.	.	.
PARROT COAL .	0	0	7	196	0	0
Parrotly blaes .	0	0	1			
BLACKBAND IRONSTONE	0	0	2½			
Fakes and blaes .	0	1	2½			
COAL .	0	1	8½			
Strata	.	.	.	.	.	.
COAL .	0	1	1½	198	0	0

Lower Part of Carboniferous Sequence.

		Thickness.			Depth.		
		Fms.	Ft.	In.	Fms.	Ft.	In.
COAL	Strata	0	1	6½	200	0	0
IRONSTONE	Strata	0	0	3	211	0	0
LIMY IRONSTONE	Strata	0	0	1½	218	0	0
TOP HOSIE LIMESTONE	Strata	0	0	8	231	0	0
1ST KINGSHAW LIMESTONE	Strata	0	1	9	234	0	0
2ND KINGSHAW LIMESTONE	Strata	0	2	6	241	0	0
BIRKFIELD OR MAIN HOSIE LIMESTONE	Strata	0	3	0	244	0	0
Strata, mainly sandstone		6	0	0	250	0	0

Reference has been made in another Memoir to the Gartsherrie, Burnlip, and Haggmuir bores.¹ These lie some miles to the north of the area at present under discussion, but are useful for purposes of correlation. From a comparison of the graphic sections of these bores, with the one of which details have just been given, it appears that there is probably a fault in the latter cutting out the position of the Kilsyth Coking Coal. This is confirmed by the unusual inclination of the metals at 220 fms., approximately the depth at which this coal would have been expected. As regards the remaining coals in the journal, all that can be said is that the probable Bannockburn Main Coal of Haggmuir and Burnlip must form one of the group ranging from 193 to 200 fms. at Muirhouse. The coal at 147 fms. at the latter locality is thin or absent in all three of the bores which have been cited for comparison. The Hirst Coal is thin at Haggmuir and Gartsherrie, but measures 1 ft. 9 in. of foul coal at Burnlip. This coal was also proved in a bore about a mile south of the Muirhouse bore, where a thickness of 1 ft. 5 in. is recorded.

A somewhat more satisfactory correlation can be made with the districts to the south and east. The two thin ironstones at 211 and 218 fms., the latter of which is associated with marine fossils, are attenuated representatives of the Hogg Fence Ironstones of Wilsontown. The two coals at 198 and 200 fms. together probably represent the Tower Coal of Carluke, which in turn is equivalent to the Main Coal of Wilsontown and Bathgate. Lastly the coal with a fireclay parting at 193 fms. is most likely the Fireclay Craw Coal of Wilsontown, which passes laterally into the Ladymorton or Jewel Coal of the region near Bathgate.

The prospect of working Carboniferous Limestone Coals in the northern part of Area VII. cannot be said to be very encouraging. It seems likely that the Wilsontown Main Coal can be traced into the ground in question, and it is possible that this seam is an extension of the Bannockburn Main Coal of an area much farther north. The two are in any case somewhat close, but there is no coal about that horizon which could be worked under present conditions at the depths and with the sections recorded in the Muirhouse bore.

¹ "Econ. Geol. Central Coalfield, Area V." (*Mem. Geol. Surv.*), 1916, pp. 12 et seq.

Reference should also be made to an old chisel bore "on the Woodhall Estate," which started from the Lower Drumgray position, and reached that of the Black Metals or Hogg Fence Ironstones. This bore shows a thirty-inch coal about 20 fathoms below the Index Limestone, and another of the same thickness about 30 fathoms lower. The former is approximately on the horizon of the Meiklehill Main Coal, though it would be rash to assume their identity. There is, however, perhaps sufficient evidence for thinking that the latter is the Bannockburn Main Coal of the Burnlip and Haggmuir bores. The position of the bore is not accurately known, but Woodhall House lies on the northern margin of Lanark 12 N.W. The reliability of the bore journal is also in question, but the part containing the supposed Bannockburn Main Coal agrees fairly well with the Haggmuir and Burnlip sections.

It may be stated in passing that, although the Kilsyth Coking Coal was missed in the Muirhouse bore, a coal or coals on its approximate horizon form a constant feature over much of the Central Coalfield. We have seen that both the Lower Garscadden Blackband and a possible equivalent of the Kilsyth were recognised near Rutherglen. Although individual correlations are impossible, these are both probably included in the group of Crutherland Coals, and the same applies to the Lesmahagow Gas Coal of a district a good deal farther south-east. A group of coals occurs in the same position in both the Haggmuir and Gartsherrie bores, and there seems some reason for thinking that an equivalent group, though probably of no great thickness, might have been found at Muirhouse but for the accidental presence of a fault.

In considering the advisability of further boring, it is worth while to note that the strata separating the Coal Measure coals from those in the Limestone Coal Group do not remain constant in thickness. Along the northern margin of the area, the interval between the Lower Drumgray Coal and the Index Limestone is about 200 fathoms. On the southern margin, near Cambusnethan House and elsewhere, it is probably not more than 100 fathoms, the decrease being due to the thinning of the Millstone Grit, and the absence¹ of a part of the Upper Limestone Group. Somewhat south of Cambusnethan House, Carboniferous Limestone strata are perhaps again brought to the surface by faulting along a line which almost coincides with the margin of the present area.

In the event of future boring, careful search should be made for particular fossil bearing beds such as that of *Edmondia punctatella*, which underlies the Calmy Limestone. These are of value in fixing certain horizons, and a chapter on the subject has been included in another Memoir of this series ("Description of Area V.," Chapter X.).

E. M. A.

C. MILLSTONE GRIT.

A small inlier of Millstone Grit was shown in the older series of Survey maps near Goodockhill. This has now been proved to extend to the south, along the crest of an anticline, and to be

¹ Supposed to be due to unconformity. See "Econ. Geol. Central Coalfield, Area IX." (*Mem. Geol. Surv.*), in the press.

continuous with the larger area of the same formation which extends to the south of Allanton. This strip of older rocks crosses the north-eastern corner, and runs for some distance along the eastern margin of the ground now under discussion. The following is an approximate section:—

	Thickness.			Depth.		
	Fms.	Ft.	In.	Fms.	Ft.	In.
Base of Coal Measures	11	5	3	11	5	3
Strata						
WILD COAL	0	0	9	12	0	0
HARESHAW FIRECLAY	1	0	0	13	0	0
Strata, mainly sandstone	9	3	0	22	3	0
GOODOCKHILL SLATYBAND IRONSTONE	0	3	0	23	0	0
Strata, mainly sandstone	16	0	0	39	0	0
Blaes and fireclay, with ironstone balls	8	0	0	47	0	0
Sandstone	3	4	6	50	4	6
CEMENT LIMESTONE	0	1	6	51	0	0
Strata, mainly sandstone	4	0	0	55	0	0
Position of LEVENSEAT LIMESTONE						
(Top of Carboniferous Limestone Series).						

The lower part of the above section is taken from the Muirhouse Bore, which was put down by the Tillan Burn half a mile to the north of Muirhouse (*see* Plate V., Section 5). In this bore the Cement Limestone was recognised by its characteristic *Orthis* fossil (*Derbya*¹). The blaes and fireclay horizon at 47 fms. is also of use as an index, being very persistent in the country to the east of that under description. A part of the sandstone intervening between this and the Goodockhill Slatyband position is coarse and pebbly in character, and probably a pebbly sandstone which occurs on the moorland area to the east of the old Goodockhill workings belongs to this horizon.

Goodockhill Slatyband Ironstone.—This seam is the same as the Lower Slatyband of Earlshill or Duntillan. The abandoned workings in the present district are not extensive, and lie some distance to the north-east of the farm of Goodockhill. They are bounded on the north-east side by an upthrow, and on the south-west by a large downthrow, fault. In other directions they have very likely been limited by deterioration or thinning of the seam. Grossart speaks of the ironstone at Goodockhill as having been “wrought at six, four, and two feet thick, thinning out to a few inches, and again swelling out to its original thickness.” He makes the observation that veins of galena were found in it running at right angles to the stratification, and up to a quarter of an inch in thickness, and again that quantities of mineral pitch have been found both in a fluid and solid condition in cavities in the ironstone.² There is also a record of marine fossils having been got from this horizon.³ In the Muirhouse bore no ironstone is recorded, and according to the reading adopted the position is represented either by a 7-inch or by a 9-inch coal.

¹ See “Econ. Geol. Central Coalfield, Area V.” (*Mem. Geol. Surv.*), 1916, Plate xii., Fig 2.

² “On the Upper Coal Measures of Lanarkshire,” *Trans. Geol. Soc. Glasgow*, vol. iii., 1871, p. 96.

³ J. W. Salter “On some of the Higher Crustacea from the British Coal-measures,” *Quart. Journ. Geol. Soc.*, vol. xvii., 1861, p. 528.

Hareshaw Fireclay.—The fireclay shown in the section 10 fms. above the last horizon is wrought at the Hareshaw Fireclay Mine, close to the Drumbowie Branch Railway. The section is:—

	Ft.	In.
Sandstone		
Wild coal	0	9
FIRECLAY (with some ironstone balls)	6	0
Coaly fakes	2	0
Faky fireclay		

The clay is taken by rail to Whifflet, Coatbridge, where it is burnt in Newcastle kilns, and used for the manufacture of firebrick, and of blocks for furnaces and hot-blast stoves. An analysis of the calcined material, made by Messrs. R. R. Tatlock and Thomson at the Glasgow City Analyst's Laboratory, gave the following results:—

Silica	52.74
Alumina	40.96
Oxide of iron	2.25
Titanic acid	1.66
Lime	1.52
Magnesia	.34
Potash	.38
Soda	.15
	100.00

The carbonaceous beds above and below the clay almost certainly correspond to divisions of the Bowhousebog Coal in the area farther east, which is usually in association with fireclays.

In the Muirhouse bore what is taken for this coal reads as follows:—

	In.
Sandstone	
COAL	6
Blaes	9
COAL	5
Blaes	8
COAL	6
Dark blaes	

A fireclay underlying a very hard parrot coal crosses the Tillan Burn due north of Birniehill. It is not likely to be of value, and its horizon is not known. The possible occurrence of the Bowhousebog Coal near Easthill will be referred to in a future chapter (p. 72).

E. M. A.

Our knowledge of the condition of the Millstone Grit in other parts of the district is limited to one or two bore-journals. The most important of these is a diamond boring put down by Messrs. Wm. Dixon, Ltd., from the workings of their No. 5 Pit, Govan Colliery, Rutherglen, which is shown graphically in Plate III. (Section 1). The thickness proved was 55 fathoms, and is thus the same as at Muirhouse, but the Levenseat or Castlecary Limestone, if present, was not quite reached. This seam is taken as the topmost member of the Carboniferous Limestone Series, but it is impersistent.

The Millstone Grit was entered 180 fathoms below the surface, and the bore continued for 35 fathoms in white and pinkish sandstones, with coarse bands containing quartz pebbles up to an inch in diameter. Fine grained sandstones, fireclays, coal streaks, and blaes were then encountered, the last often crowded with *Lingula*. Beneath these the Cement Limestone was cut at a depth of 230 fathoms, and the bore stopped a few fathoms lower. The Cement was developed in a highly characteristic manner, being a dark, dolomitic "bastard limestone" with abundance of Orthotetid shells on top. As the section is of some interest, details are given below :—

	Ft.	In.
Hard dark blaes, with <i>Lingula</i> and small lamellibranchs ; the lower two feet with Orthotetids also	8	3
Hard limy blaes ("Musselband") crowded with Orthotetids and <i>Myalina verneuili</i>	0	6
Parrotly blaes, with fish scales, etc.	0	4
Rough, dark, and hard irony dolomite, with finely broken crinoid and brachiopod debris (CEMENT LIMESTONE) .	3	0

R. G. C.

The thinning of the Millstone Grit towards the southern margin of the district has already been referred to. In two bores near Cambusnethan House it is probably represented by only 10 fathoms of strata, consisting mainly of sandstone.

C. H. D.

CHAPTER III.

COAL MEASURES.

Rutherglen to Bothwell.

A. RUTHERGLEN DISTRICT.

(Part of Lanark 10 N.E.)

THE Coal Measures near Rutherglen are bounded on the south-western side by a branch of the large Dechmont Fault already referred to. Mining has been active for over two centuries, so that the thick coals, down to the Splint, are practically exhausted. The Kiltongue Coal was for a long time regarded as the lowest workable seam, and although several bores had been sunk through lower strata, their evidence was conflicting. A better knowledge of the sequence has now been attained, and work has been begun in at least one lower seam.

GENERAL SECTION OF COAL MEASURES OF RUTHERGLEN DISTRICT.

	Thickness.			Depth.		
	Fms.	Ft.	In.	Fms.	Ft.	In.
Strata, mostly red sandstones, with bands of variegated marl	30	0	0	30	0	0
(Position of Skipsey's Marine Band)				30	0	0
Reddish grey and white sandstones, with partings of blaes and coal streaks	30	1	6	60	1	6
UPPER COAL	0	4	6	61	0	0
Strata	3	4	7	64	4	7
COAL	0	1	5	65	0	0
Strata, with a soft "Musselband" in centre	8	1	0	73	1	0
ELL COAL	0	5	0	74	0	0
Sandstone with a hard "Musselband" (the Cambuslang Marble) in centre	5	1	3	79	1	3
MAIN COAL	0	4	9	80	0	0
Strata, mostly sandstone	7	3	6	87	3	6
HUMPH COAL	0	2	6	88	0	0
Strata	3	5	9	91	5	9
SPLINT COAL	0	3	3	92	3	0
Strata	1	0	0	93	3	0
VIRGIN COAL	0	1	2	93	4	2
Strata	3	0	4	96	4	6
MUSSELBAND COAL	0	1	6	97	0	0
Strata	5	4	10	102	4	10
BLACKBAND COAL	0	1	2	103	0	0
Strata	5	4	4	108	4	4
VIRTUEWELL COAL	0	1	8	109	0	0
Strata	5	4	9	114	4	9

	Thickness.			Depth.		
	Fms.	Ft.	In.	Fms.	Ft.	In.
LADYGRANGE COAL	0	1	3	115	0	0
Strata	6	4	0	121	4	0
KILTONGUE MUSSELBAND	0	2	0	122	0	0
Strata	5	0	7	127	0	7
KILTONGUE COAL	0	2	5	127	3	0
Strata	8	3	5	136	0	5
? UPPER DRUMGRAY {	COAL	0	0	5	136	0
	Blaes	0	0	5	136	1
	COAL	0	0	4	136	1
	Strata	3	1	0	139	2
? MID DRUMGRAY COAL	0	0	10	139	3	5
Strata	1	3	7	141	1	0
COAL	0	0	3	141	1	3
Strata	1	0	3	142	1	6
? LOWER DRUMGRAY {	COAL	0	1	2½	142	2
	Strong coaly blaes	0	0	2	142	2
	COAL	0	0	4	142	3
	Strata	1	2	7	143	5
COAL	0	0	5	144	0	2½
Strata	3	3	6	147	3	8½
COAL	0	0	8½	147	4	5
Strata	3	0	7	150	5	0
COAL	0	1	4	151	0	4
Rib	0	0	0½	151	0	4½
COAL (strong splint)	0	0	4	151	0	8½
COAL (free)	0	0	3	151	0	11½
Strata	1	4	10	152	5	9½
Coaly blaes	0	2	2	153	1	11½
COAL	0	1	2	153	3	1½
Blaes and Sandstone	0	0	4	153	3	5½
COAL	0	0	6	153	3	11½
Strata	3	1	9	156	5	8½
COAL	0	0	1	156	5	9½
Strata	1	5	2	158	4	11½
COAL	0	0	2	158	5	1½
Strata	7	2	4	166	1	5½
COAL	0	0	1½	166	1	7

The upper part of this section is compiled from various sources, among which may be mentioned the section of No. 4 Pit, Govan Colliery (*see* Plate II., Section 1). The lower part is taken direct from the bore from the Kiltongue Coal at No. 5 Pit, Govan Colliery, which has been referred to (p. 13), and is reproduced in graphic form in Plate III. (Section 1). The lowest coal is regarded as the base of the Coal Measures, since massive sandstones, with pebbly bands, such as characterise the Millstone Grit strata, were entered immediately below. It may be stated that the Crofthead Slatyband Ironstone position, which is elsewhere taken as the base, can nowhere be identified with confidence in the present area. It is consequently difficult to fix a dividing line between the two formations.

The supposed Lower Drumgray of the General Section is the coal already referred to as now being wrought beneath the Kiltongue seam.

The *Kiltongue Coal* is of excellent quality, and averages two feet in thickness over the district as a whole. It was wrought out some years ago in the Wellshot Colliery, and has mostly been taken out to the west of Rutherglen. Considerable areas remain however round Farme Colliery, also south of Bankhead and Crosshill.

The *Kiltongue Musselband*, with its so-called oil-shale, appears to be typically developed in this district, but has never been wrought. A specimen from No. 6 Pit, Govan Colliery, shows the usual parrotty blaes, crowded with crushed "mussels" or *Carbonicola*. In sinking this pit to the Kiltongue Coal, the "shale" is stated to have been found three feet in thickness.

The *Ladygrange*, *Virtuewell*, and *Blackband* Coals are known, but are all too thin to work at present. In No. 6 Pit, Govan Colliery, the *Virtuewell* has been found to be 20 inches in thickness. In several bores which were put down by Rutherglen Corporation, about the year 1900, to the south of High Crosshill, this seam was in more than one division. One section was:—

	Ft.	In.
Soft blaes	0	11
COAL	1	0
Fireclay	1	8
COAL	0	4
Coaly blaes	0	11
COAL	1	5

Three of these bores also show the *Blackband* Coal, which is in two leaves, averaging a foot each, and separated by two or three inches of parting. Other bores in the Rutherglen district on the whole give an inferior thickness.

The *Musselband* Coal has been worked in the disused Fishescoats Colliery, south-east of High Crosshill. The following average section was taken from these workings:—

	Ft.	In.
Sandstone, fakes, etc.		
IRONSTONE	0	1
Blaes and ironstone balls	0	10
COAL	0	8
Split and fireclay	0	9
COAL	1	1
Sandstone		

In the Corporation borings at Crosshill the parting was greater. The two coals were each about a foot, and separated by 5 ft. 5 in. of blaes with "mussel rib" and fireclay.

The *Virgin* or *Sourmilk* Coal is of little account in this district. In No. 4 Pit, Govan Colliery (close to Glasgow Road, and just north of the railway), it was 14 inches in thickness, and was known as the *Splint* Main, or *Foot* Main Coal.

The *Splint* Coal, which is the lowest of the thicker seams, is now practically exhausted. It was worked to the crop from the old Bankhead Pit, and also at Fishescoats, where the section was:—

	Ft.	In.
Faky blaes	3	0
Limy ironstone	0	2
Faky fireclay	0	6
COAL (wild)	0	4
COAL (splint)	1	7
COAL (free)	1	7
Coarse fireclay		

The *Humph Coal* is about 30 inches in thickness. It is possible that some of this seam may still be intact near the long disused Bankhead Pit, south-west of Crosshill.

The *Main* and *Ell Coals* are practically wrought out. Between the two horizons is a 15-inch limy ironstone, packed with crushed shells of *Carbonicola*, known farther east as the "Cambuslang Marble" (see p. 36). Another musselband occurs between the *Ell* and the *Upper Coal*, but this is a soft band, the shells being embedded in blaes.

The *Upper* or *Upper Ell Coal* is as well developed near Rutherglen as in any part of the Lanarkshire field, and averages 4 ft. 6 in. in thickness. In the Farme Colliery workings, north of Rutherglen, a remarkable series of sandstone "washouts," or wants, were found in this seam.¹ Two channels were found, one of them about 200 yards east of the pit-bottom. In the discussion referred to, three channels were noted, but since that time the "Mid" and "East wants" have been proved to run together, forming parts of a curious twisted course, which runs south towards the Clyde Paper Mills, then bends round sharply towards the north, in which direction it dies out. The breadth was about 80 yards. The western channel was more extensive. Passing through the pit-shaft, it ran south-west for over a mile, having been traced at least as far as the 45-fathom fault at the West Quarries. Under Main Street this channel was proved to be 400 yards wide, a curious little island of workable coal being found in the middle. The coal was frequently "doubled" along the sides of the channel, and was said also to be of better than average quality: at the same time the components of the original seam were repeated in their normal order—Top Coal, parting, Bottom Coal. As seen in the workings, the junctions of sandstone and coal were exceedingly sharp and clean. They were also very irregular, narrow tongues of sandstone frequently projecting into the surrounding coal. It is reported that stone mines driven through the want found the sandstone coarse and pebbly at its base, as if it marked the bed of a stream.

The overlying *Barren Measures* are not seen in stream sections, and can only be partially studied in quarries which are now disused. Our knowledge of their character is chiefly derived from the records of bores and pit sections, especially at the pits of Messrs. Wm. Dixon, Ltd. These show that the strata are mostly red and grey sandstones, with partings of white and variegated marl, and containing some black blaes with coals which are not over 10 inches in thickness. In the journal of No. 5 Pit, Govan Colliery, a "marble band" is recorded at a height of 30 fathoms above the *Upper Coal*. This may perhaps be Skipsey's Marine Band, of which, however, we have no certain knowledge in this district.

The sandstones in the *Barren Measures* have been wrought at West, Stonelaw, and Eastfield Quarries, the last of which affords the best section. These will be further referred to in the chapter on Sandstone Quarries (p. 127).

¹ *Trans. Mining Institute (Scotland)*, vol. vi. (1884-5), Pl. xxiv., pp. 234-237, in the discussion on Mr. Barrowman's paper, "Doubling of the Splint Coal at Swinhill Colliery."

The Coal Measures in the district are arranged in the form of a broad syncline, whose axis passes east and west through the town of Rutherglen. Apart from the Dechmont Fault, the chief fault is one which runs from west to east between Rutherglen and Crosshill, with a downthrow to the north of about 50 fathoms.

R. G. C.

B. UDDINGSTON AND BOTHWELL DISTRICT.

(Lanark, 11 N.W., S.W., N.E., S.E.)

The Uddingston and Bothwell District contains the deepest part of the Central Coalfield. In Hallside Colliery the Upper Coal, which is the highest yet worked in Lanarkshire, lies at a depth of nearly 200 fathoms.

In the greater part of the district the Productive Coal Measures are covered by a considerable thickness of Upper, Red, or Barren Measures, which in the colliery just named must amount to about 160 fathoms. Various pit and bore sections in Lanark 11, are drawn up in graphic form in Plates II. and III. While there is a certain amount of local variation, the following may be regarded as an average sequence for the district.

GENERAL SECTION OF COAL MEASURES OF DISTRICT OF UDDINGSTON AND BOTHWELL.

	Thickness.			Depth.		
	Fms.	Ft.	In.	Fms.	Ft.	In.
Red and purple sandstone and marls	110	0	0	110	0	0
White and brown sandstone, blaes and fireclay, with local reddening, and including from 9 to 16 thin coal seams	79	1	0	189	1	0
UPPER, "WANDERING" or MOSSDALE COAL from 9 in. to	0	5	0	190	0	0
Strata, average	7	5	4	197	5	4
COAL	0	0	8	198	0	0
Strata, average	8	5	0	206	5	0
ELL COAL, ... from 4 ft. to	1	1	0	208	0	0
Strata, average	3	4	6	211	4	6
MUSSELBAND IRONSTONE (The "Cambuslang Marble") from 6 in. to	0	1	6	212	0	0
Strata, average	4	1	0	216	1	0
PYOTSHAW COAL from 2 ft. 6 in. to	0	5	0	217	0	0
Strata, average	3	0	6	220	0	6
MAIN COAL, ... from 3 ft. to	0	5	6	221	0	0
Strata, average	7	3	0	228	3	0
HUMPH COAL, ... from 1 ft. to	0	3	0	229	0	0
Strata, average	6	1	0	235	1	0
SPLINT, ... from 3 ft. to	0	5	0	236	0	0
Strata, average	0	3	6	236	3	6
VIRGIN or SOUR-MILK COAL from 1 ft. 6 in. to	0	2	6	237	0	0
Strata, average	10	4	0	247	4	0
BLACKBAND COAL	0	2	0	248	0	0
Strata, average	9	3	2	257	3	2
VIRTUEWELL or BENHAR COAL . from 8 in. to	0	2	10	258	0	0
Strata, average	8	5	0	266	5	0

		Thickness.			Depth.		
		Fms.	Ft.	In.	Fms.	Ft.	In.
KILTONGUE MUSSELBAND SHALE	from 5 in. to	0	1	0	267	0	0
Strata, average		7	0	6	274	0	6
KILTONGUE COAL	from 6 in. to	0	5	6	275	0	0
Strata, average		5	4	0	280	4	0
UPPER DRUMGRAY COAL	from 1 ft. to	0	2	0	281	0	0
Strata, average		9	3	6	590	3	6
LOWER DRUMGRAY COAL	from 1 ft. 6 in. to	0	2	6	291	0	0
Strata, average		10	0	0	301	0	0
BALMORAL COAL							

In the above section the position of Skipsey's Marine Band, which is taken as the base of the Red or Barren Measures, is not indicated, as its occurrence in the district is not known with certainty. Its horizon does not coincide exactly with the change in colour of the sediments, which takes place at different levels in different parts of the coalfield. The estimate of the thickness of Barren Measures present at Hallside is made on the assumption that their base lies 50 fathoms above the Ell Coal. On the same supposition the underlying Productive Measures have a thickness of about 150 fathoms down to the Balmoral Coal. The Coal Measure strata which come below the latter seam in this district are so little known that it would be rash to represent them by a general section. If however we take as their base the lowest coal in the Craighead bore which will shortly be referred to, the total thickness of Productive Coal Measures is about 167 fathoms.

The coal seams are deepest over a comparatively restricted area in the centre of the district. They rise to all points of the compass, but on the south-west they are soon cut out by the large Dechmont Fault.

The district includes more than thirty working collieries, in which about 15,000 men were employed underground in 1914. In 1916 no seam below the Virgin was being wrought in the central or deepest part of the district, except at Dechmont Colliery. Here and at some collieries on the southern and eastern margins the Blackband Coal was also wrought. Those exploiting the lower group, which includes the seams from the Virtuewell to the Lower Drumgray, were confined mainly to the north. This group appears to deteriorate, so far at least as concerns this district, when followed from north to south, and cannot be looked on as containing any material reserve of coal in the deepest part of the basin. The Blackband Coal, on the other hand, although rather thin, is fairly constant in thickness, at an average of about two feet.

The upper group of coal seams, including the Ell, Main, and Splint, as well as certain thinner coals, is, owing to its depth in certain parts of this area, on the whole less exhausted than in the shallower districts to the north and east. This does not imply that considerable inroads have not been made, more especially in the Ell and Splint seams.

Strata below the Balmoral Coal.—A blind bore in Craighead No. 1 Pit went down to 92 fathoms below the Virgin Coal, and by the

courtesy of Messrs. Wm. Baird & Co., Ltd., is represented in graphic form on Plate III. (Section 4). Unfortunately no coal seam below the Blackband can be recognised with certainty, but it seems probable that the bore reached a point some 30 or 35 fathoms below the Lower Drumgray. The following section was met with a few fathoms above the base:—

	Fms.	Ft.	In.
Faky sandstone	1	0	0
Faky blaes	0	2	0
COAL.	0	0	7
Dark fakes	0	1	0
Blaes	0	0	6
COAL.	0	1	6
Dark fakes	0	0	6
Sandstone	1	2	0
COAL.	0	0	7

The coals are all too low to correspond with the Balmoral, and the last item may be taken as representing roughly the base of the Coal Measures in this district.

Balmoral Coal of Coatbridge.—This seam is distinct from the Balmoral Coal of the Slamaunan District, and is the same as the Mill Coal of Armadale. It is known to be in fairly good form in the southern portion of Lanark 7 S.W., and may be represented (though this is not certain) by a 2-foot coal in a blind bore in Broomhouse Colliery. As this lies only a few yards to the north of Lanark 11, a workable area of this seam may extend into the district at present under discussion. A seam named the Balmoral in the Home Office Returns is in fact being worked at Carmyle Colliery. A blind bore in this colliery, and a bore near Bogleshole (No. 4) Pit of Clyde Ironworks Colliery, agree in showing a double coal, with a separation of 2 or 3 fathoms, about this horizon. The lower coal at Carmyle is the thicker, and is presumably the one which is worked. It is not known which of these two seams really represents the horizon, and the possibility of the seam having split cannot be excluded.

The coal may correspond to one or other of three seams at Craighead, the lowest of which is 9 inches, and the other two a foot each in thickness. It would appear however to measure only 6 inches in a blind bore in Gateside No. 2 Pit (Plate III., Section 2).

Lower Drumgray Coal.—This coal has only been wrought hitherto along the northern margin of the district. Although there are local variations it is usually a good house coal, with an average thickness of two feet in the workable area.

Four collieries were working this seam within the district in 1916. An extra seam occurs about two fathoms below the supposed Lower Drumgray at Carmyle Colliery, and is also represented in the bore near Bogleshole Pit already referred to. The accepted interpretation is on the whole the most probable, but perhaps the term Lower Drumgray should include both seams.

The pithead of Calderbank Colliery lies outside the district, to the

north, but the workings in this coal extend into Lanark 11 for some considerable distance, to the east of Broomhouse. The section here is :—

	Ft.	In.
COAL	1	6
Parting	0	5
COAL	0	10

In the former workings from No. 3 Pit, Bredisholm, which also lies just off the map, the seam was generally 2 ft. 6 in. in thickness, but was sometimes split by a thin "dirt" parting. This parting is said to thicken towards the south-west. Boring operations are supposed to have proved the seam with a thickness of two feet at Haughhead, and of 21 inches at Newton No. 2 Pit (*see* Plate III., Section 3). In both these cases there may be a doubt whether a lower division of the seam has actually been reached. At Gateside No. 2 Pit the section in the blind bore already referred to is as follows :—

	Fm.	Ft.	In.
Blaes	2	1	7
COAL	0	1	8
Blaes	0	0	4
Fakes and sandstone ribs	0	2	0
Blaes	0	2	2
COAL	0	1	4
Fireclay	0	0	1
Faky sandstone	0	5	0

At Tannochside the worked seam measures 30 inches of coal with a blaes roof. In the middle and southern portions of the Rosehall field the average is :—

	Ft.	In.
Grey fakes	3	0
COAL	2	8
Bastard fireclay		

The holing has here to be done in the seam itself, with a corresponding proportion of loss. An analysis of the coal kindly communicated by Mr. J. D. Miller gave the following results :—

Analysis of Lower Drumgray Coal, Rosehall Colliery.

Volatile constituents	44·32	{ Gas, tar, etc.	36·06
		{ Sulphur	·26
		{ Water	8·00
Coke	55·68	{ Fixed carbon	51·84
		{ Sulphur	·39
		{ Ash	3·45

The seam was formerly coked at this colliery for blast furnace use.

At East Parkhead Colliery a blind bore gives the following record :—

	Ft.	In.
Dark faky blaes	3	9
COAL	2	6
Dark fireclay	1	6

but another at Douglas Park Colliery, half a mile to the south, found only 1 ft. 5½ in. of coal in the position (*see* Plate III., Section 6). The seam is very difficult to identify in the bores in the southern part of the district. It is evidently thin, but may be represented by 1 ft. 8 in. of coal in the bore at Craighead already referred to.

We thus see that, so far as this district is concerned, the Lower Drumgray is at its best in the north-eastern quarter-sheet (11 N.E.). Westwards it probably splits, and southwards it deteriorates in thickness.

Upper Drumgray Coal.—The musselband, which forms a prominent feature a little above the Upper Drumgray in most of the Central Coalfield, has seldom been recorded in this district, and identification of this seam is thus rendered sometimes uncertain. It has been worked, for instance, at Broomhouse Colliery (just beyond the northern margin of Lanark 11), under the name of "Under Kiltongue." Only one colliery—Kenmuir—was extracting the coal in 1916 in the Uddingston and Bothwell area, and the workings have since been abandoned. The section was:—

		Ft.	In.
Blaes with sandstone ribs	.	2	0
Dark hard blaes	.	0	6
COAL	1 ft. 4 in. to	2	0
Fireclay	1 ft. to	2	0

The "Under Kiltongue" at Broomhouse has the section:—

	Ft.	In.
Fakes and sandstone		
COAL	1	8
Daugh	0	5
Faky sandstone	2	4
COAL	0	10

In spite of the difficulty referred to, the seam can be identified in a good many bore sections in other parts of the district. In the diamond bore at No. 2 Pit, Newton Colliery, it measures 14 inches, with a blaes roof and a pavement of dark fakes (*see* Plate III., Section 3). In the blind bore from No. 2 Pit, Gateside (Plate III., Section 2), the thickness is only a foot, while at Clydeside Colliery it is no more than six inches. Farther east it recovers its thickness to some extent. The section in No. 2 Pit, Tannochside, is as follows:—

	Ft.	In.
Strong fakes	6	3
Blaes	2	4
COAL	1	3
Fireclay	3	0
COAL	0	2

The seam appears to have died out altogether in a bore at East Parkhead Colliery, but in the one at Douglas Park Colliery, not far to the south, it again measures 15 inches in thickness (Plate III., Section 6). From this point it is impossible to trace it with

confidence. In the blind bore in No. 1 Pit, Craighead, it may be represented by a coal in two leaves :—

	In.
COAL	8
Parting	2
COAL	10

But the identification is very far from certain. In a bore in No. 4 Pit, Blantyre, the seam may be represented by a 15-inch coal.

It will thus be seen that except along the northern margin of Lanark 11 N.W., this coal hardly attains a thickness which is likely to make it workable under present conditions, more especially if we take into account its unusual depth.

Kiltonque Coal.—This seam, like the last described, is often identified by the presence a certain distance above it of a band of “mussels” accompanied by a shale or shaly blaes. The distance of the coal below the index bed is however greater, and the Musselband will be further referred to under a separate heading.

All the collieries, except Whistleberry, which are at present working this seam in the district, lie along its northern margin. The coal is here better developed than in the remainder of Lanark 11, where it barely attains a workable thickness.

At Kenmuirhill the seam was reached by a cross-cut from the Virtuewell workings, and proved to be two feet thick. At Broomhouse Colliery it sometimes exceeds this figure, but the top two or three inches are often in a “burnt” condition. A recent blind bore at Clydeside found the coal 2 ft. 8 in. in thickness, about $7\frac{1}{2}$ fathoms below the Musselband. Eastwards two or more partings make their appearance, while the total thickness of coal increases. In Bredisholm No. 3 Pit (the pithead is just off the map) the coal is in three leaves, all of which are worked.

One section gives :—

	Ft.	In.
COAL	1	0
Stone	0	2
COAL	1	6
Fireclay	0	10
COAL	3	0

On the north side of the east and west fault at Tannochside the seam is in four leaves. The section varies a good deal, but the following is given for a part of the workings :—

	Ft.	In.
Sandstone		
COAL	0	10
Stone	0	3
COAL	1	1
Slit	0	3
COAL	2	1
Slit	0	1
COAL	1	0
Fireclay		

The last item is 4 feet thick, and overlies an 11-inch coal. The seam is also in four leaves in one part of the Rosehall workings, but the leaves are usually thinner, and the lowest, being a “wild” coal,

is not taken out. The top leaf is 5 inches thick, and is described as splint. The underlying fireclay is here in places very white, and might perhaps prove useful.

The average section of the supposed Kiltongue Coal at Whistleberry Colliery is 17 inches. It lies 3 or 4 fathoms below a seam which is called the Upper Kiltongue, and about 11 fathoms below a shaly blaes which may be that which accompanies the Musselband.

Some attention may next be given to localities where the seam is still intact. In the northern part of the district the horizon can always be identified. In the bore in Gateside No. 2 Pit the coal is in three leaves as follows :—

					Ft.	In.
Blaes						
COAL	.	.	.	.	0	2
Blaes	.	.	.	.	0	5
COAL	.	.	.	.	0	2
Blaes	.	.	.	.	0	3
COAL	.	.	.	.	1	6
Blaes	.	.	.	.	1	0

The blind bore in Newton No. 2 Pit found the seam in one division, with a thickness of 19 inches. The similar bore in Douglas Park Colliery proved the position, but only 9 inches of coal were present, while at East Parkhead and Hamilton Palace Collieries it is still thinner.

The last three records show an agreement which is evidently not accidental, but indicates the inferiority of the seam for a square mile or more to the east of Bothwell. South of the Clyde it may again be better developed. A coal named the Kiltongue is, as we have seen, being worked at Whistleberry, but difficulties here arise as to the correlation. At Craighead the next coal above the one suggested as the Upper Drumgray is 17 inches in thickness, with a roof and pavement of sandstone. At No. 4 Pit, Blantyre Colliery, a coal one foot in thickness occurs about three fathoms above the 15-inch coal, about which a similar suggestion was made.

Kiltongue Musselband.—The Kiltongue Musselband is of no economic value in this district, but its importance as an index has already been noticed. In the shaft at Bogleshole Pit (No. 4 Pit, Clyde Ironworks Colliery) the section is :—

					Ft.	In.
SHALE	.	.	.	.	1	0
MUSSELBAND	.	.	.	.	1	0
Hard stone	.	.	.	.	0	2
COAL	.	.	.	.	0	7

There is no coal or shale here between this position and the Kiltongue Coal. The shale and coal on the Musselband horizon are sometimes found in bores in which no "mussels" are recorded. The height varies from 3 to 6½ fathoms, and possibly sometimes more, above the Kiltongue Coal.

A thin coal seam has been proved a few fathoms below the Virtuewell in many bores in this district. It may or may not be

the Ladygrange, which is rather better known in the adjoining district of Mossend. It is usually only a few inches thick, but it is on the whole probably this seam which measures 15 inches in the Craighead bore. The item was recorded in the bore journal as the Virtuewell Coal, the true Virtuewell being, as we take it, only 8 inches in thickness.

Virtuewell Coal.—In the Uddingston and Bothwell district this is often of little value. Nevertheless, it is coming to receive more attention, and in 1916 was being worked at the following collieries:—Clyde Iron Works, Kenmuir and Bogfield, Kenmuirhill, Bredisholm, Tannochside, and Rosehall. As is almost always the case with the seams so far considered, the field of operations is as yet confined to the northern margin of the district. The position is usually less than 10 fathoms above the Kiltongue Musselband, but at Douglas Park and Hamilton Palace Collieries it is 13 or 15 fathoms.

At Clyde Ironworks Colliery the seam is in two leaves, with a parting of fireclay. At Kenmuirhill No. 1 Pit it is also double, the section being:—

	Ft.	In.
COAL	2	0
Faky blaes	2	6
COAL	1	4

Only the upper leaf is at present being worked. At No. 3 Pit, Bredisholm (just beyond the northern margin of Lanark 11), the section is:—

	Ft.	In.
Rock		
COAL	2	0
Fireclay		

At Tannochside No. 1 Pit the thickness is 2 ft. 10 in., and it is interesting to note that the Cleland Roughband Ironstone is represented a short distance above the top (*see* p. 77).

In the remainder of the district the development is decidedly inferior. Bores in Clydeside and Haughhead Collieries show the coal to be thinner in this vicinity than in the collieries working it on either side. In the blind bore at No. 2 Pit, Newton Colliery, the double section is repeated as follows:—

	Ft.	In.
COAL	0	8
Blaes	1	10
COAL	0	6

The similar bore at No. 2 Pit, Gateside, found a greater thickness of coal, with, unfortunately, a greater separation:—

	Ft.	In.
COAL	1	6
Fireclay and blaes	5	8
COAL	1	8

A blind bore in No. 4 Pit, Blantyre, proved a thickness of 2 ft. 4 in., with a roof of blaes and sandstone plies. In

a surface bore near No. 2 Pit, however, the seam was again divided:—

	Ft.	In.
Grey fakes		
COAL (strong splinty)	1	6
Light fireclay	1	4
COAL	0	10
Light grey fakes	4	3

A blind bore in Greenfield Colliery (*see* Plate III, Section 5) gave this section in the probable Virtuewell position:—

	Ft.	In.
COAL	0	8
Fakes	1	0
Faky sandstone	1	6
Faky fireclay	0	5
COAL	1	3

but another in the same colliery records no coal whatever on the horizon. The poor development at Craighead has already been referred to. In No 1 Pit, Hamilton Palace Colliery, the coal has a thickness of 1 ft. 9 in., with a roof of fakes and pavement of fireclay. At Orbiston Colliery the seam was sunk to, and measured 15 inches. In the bore at Douglas Park Colliery the thickness was 13, and in another at East Parkhead only 8 inches.

We thus see the exceedingly variable nature of this coal seam, which except possibly at Blantyre, never attains a thickness in the rest of the area, similar to that of the workable areas to the north.

Blackband Coal.—In contrast to the Virtuewell, the Blackband Coal maintains a fairly constant thickness over a large part of the area under discussion. It is worked in various collieries in the marginal or shallower parts of Lanark 11, and in one pit—Dechmont No. 3—not very far from the central or deepest portion.

At Bredisholm No. 3 Pit (just beyond the northern margin of the area) the section is:—

	Ft.	In.
Rock		
Fakes	4	0
COAL	1	0
Stone	1	9
COAL	2	0
Sandstone		

In Tannochside No. 1 Pit the following:—

	Ft.	In.
Sandstone	1	8
Blaes	1	1
Ironstone ribs	1	3
COAL	1	2
Dirt	0	9
COAL	1	4
Fireclay		

In the shaft of Orbiston No. 2 Pit the thickness of the coal is recorded as 25 inches, while blind bores at Greenfield and Whistleberry give 23½ and 21 inches respectively. In the latter case the roof is of blaes and the pavement of fakes.

The above information refers to localities where the coal is at present worked. In quality the seam is usually classed as a good house coal. The following additional details are taken from bores in or near collieries where the seam is still undeveloped (1916).

Colliery.	Depth below Splint or Virgin.	Thickness.	Roof.	Pavement.
	Fms.	Ft. In.		
Gateside No. 2 Pit		2 0 (including 2 partings of "scilly coal" each 1 in.)	Blaes and ironstone.	
Newton No. 2 Pit .	10½	2 3 (inferior with hard slaty plies)	Fakes.	Fakes.
Haughhead . .	11	2 2	Fakes and blaes.	Fakes.
Viewpark . .	12	2 0	Faky blaes.	Fakes.
Bothwell Park . .		1 1		
East Parkhead . .	12	2 0		
Douglas Park . .	12	1 11	Blaes 1 ft. overlain by sandstone.	Blaes and ribs.
Hamilton Palace—				
Pit No. 1 . .	9½	0 9	Blaes.	Sandstone.
Pit No. 2 . .	9½	2 0	Blaes.	Sandstone.
Craighead . .	11½	2 3	Black blaes.	Fakes.
Blantyre No. 4 Pit	13½	2 2	Fakes.	Fakes.
" No. 2 Pit	10½	2 6 (top 4 in. foul.)	Blaes.	Blaes and fakes.

It will thus be seen that this coal maintains a thickness which is on the whole remarkably uniform, and that if the same may be assumed as regards the quality there are important reserves of coal on this horizon, below the coals at present worked, over much of the Uddingston and Bothwell District. There is an area near Low Blantyre, and in the immediate neighbourhood of Bothwell, within which there is apparently no direct information regarding this seam. Assuming it to be as well developed here as in the adjoining areas to north and south, a very rough estimate shows that probably 20,000,000 tons of Blackband Coal still await development within the four quarter sheets of Lanark 11. As the Splint Coal has nearly everywhere been sunk to, the lower seam should easily be reached. The only part of the district in which the condition of this coal is unsatisfactory—so far as has at present been proved, and apart from individual records like that at Bothwell Park Colliery,—lies along the northern margin of Lanark 11 N.W. A cross cut at Broomhouse found a foot of wild coal in the Blackband position, while in Kenmuir No. 1 Pit, north of Carmyle, the seam is represented by only 6 inches of coal of a similar description.

No blackband ironstone is in this district included in the seam, and though occasionally, as at Tannochside, the coal is overlain by ribs of clayband, it is not known that any attempt has been made to work them.

Musselband Coal.—A musselband with an underlying coal is often present in this district in the position of the Musselband Coal and ironstone, the former of which has been wrought for instance in the district of Greengairs. The seam, however, is not probably of economic importance in the present area. The “mussels” are often preserved in ribs of limy ironstone occurring at intervals in blaes or parrotty blaes, but these ribs, as well as the underlying coal, are too thin and poor to be workable. The position is usually three or four fathoms below the Virgin Coal.

The blind bore in Newton No. 2 Pit gives the following record:—

	Ft.	In.
MUSSELBAND	0	4
Blaes and hard rib	3	4
COAL	0	10
WILD COAL	0	6

and a surface bore 300 yards west of Blantyre No. 2 Pit gives:—

	Ft.	In.
Blaes with ribs of ironstone from 1 to 3 in. thick	6	0
Blaes and small ribs	2	6
COAL (free)	1	5
COAL (foul parrot)	0	5

Other bores show a thinner coal in the same position, but sometimes both coal and ironstone appear to be wanting. It is probable, however, that a careful search would have found the “mussels” in many cases where they have not been recorded.

Splint and Virgin Coals.—These two seams are occasionally united, and often so close as to form a single working. The Splint Coal is regarded as the most constant and regular of all the Lanarkshire seams, and owing to its hard splinty nature has long been much used for blast furnaces. It can be extracted in large blocks, without much dross, and these blocks withstand the pressure of a furnace without breaking up into small material, and thus choking the draught. It should be noted, however, that in this district the seam does not consist entirely of splint, but includes “free” and occasionally parrot coal.

Where the seams are separate the Virgin is usually distinctly the thinner. It is classed as a good house coal, but the value is often lessened by the presence of partings of sediment. The Splint Coal was being worked in 1916 in about half the collieries in the district. In a few cases old workings have been abandoned, perhaps owing to the local exhaustion of the seam.

In certain sometimes rather sharply defined areas the Splint Coal of this district is so “burnt” as to be unworkable. This applies for instance to Kenmuirhill Colliery, where, however, the Virgin Coal is in part at least quite “clean.” Although the point has not been verified, it seems probable that in this, and the other instances which will presently be mentioned, the “burnt” coal is of the calcareous type, and not of the sort which is due to the influence

of intrusions.¹ The two varieties have much in common, as they are both softer than ordinary coal, and readily break down into small material. They have both also an unusually high percentage of ash. But the absence of any igneous rock in certain cases compels us to assign the alteration to some different cause.

The parting between the Splint and Virgin Coals is at its maximum in the two northern quarter-sheets. The shaft section in Bogleshole Pit (No. 4 Pit, Clyde Iron Works Colliery) reads as follows (*see* Plate II., Section 2):—

	Ft.	In.
Blaes with ironstone balls	1	8
HARD SPLINT COAL	3	6
Fireclay	2	1
Blaes	2	0
Kingle rib	0	6
Blaes	1	2
VIRGIN COAL	2	3
Fireclay with ribs of coal		

At Kenmuir No. 2 Pit, to the east of Carnyle, which ceased working in 1882, the lower seam read:—

	Ft.	In.
Sandstone 9 in. to	1	6
Blaes	0	10
COAL	1	10
Slit	0	3
COAL	0	8
Faky fireclay		

At Westburn Colliery the Virgin is also divided, the section being:—

	Ft.	In.
COAL	1	11
Coaly fireclay	0	6
COAL	0	6

Near Holmhills Farm, to the south of Cambuslang, the Splint Coal was proved near the crop by a shallow pit, and was three feet in thickness. At Gateside Colliery this coal is unusually thin, the section being:—

	Ft.	In.
Ironstone rib	0	1
Blaes	0	6
SPLINT COAL	1	2
FREE COAL	1	0
Daugh	0	4
Hard fireclay		

In one part of Hallside Colliery this coal is again about 3 feet thick, the roof being a strong sandstone. The Virgin lies about 12 feet below, with the section:—

	Ft.	In.
COAL	1	3
Slit	0	0½
COAL	0	10

¹ R. W. Dron. "The Occurrence of Calcareous Coal in a Lanarkshire Coalfield," *Trans. Inst. Min. Eng.*, vol. xxvii., 1904, p. 92. *See also* pp. 120-121 of the present volume, and "Econ. Geol. Central Coalfield, Area V.," (*Mem. Geol. Surv.*), 1916, p. 76.

On the north-eastern side of the pit is an area of the "burnt" coal referred to, measuring 1600 feet by 400 feet, with its long axis perpendicular to the direction of a west-north-western dolerite dyke which happens to coincide with its northern margin.

At Haughhead Colliery the Splint Coal measured 40 inches, but the workings have long since been abandoned. At Bothwell Castle Colliery this seam averaged 44 inches with a sandstone roof, and the Virgin 25 inches in thickness. The two were here wrought in one working.

Towards the southern margin of the district, the two seams approach one another very closely. Thus in a bore near No. 4 Pit, Blantyre, which makes the Splint Coal 4 ft. 3 in., and the Virgin 2 ft. 8 in. in thickness, the separation consists only of 13 inches of black blaes. A somewhat similar parting is present at Whistleberry Colliery, but in the Greenfield workings it is further reduced to 3 inches. Two blind bores in another part of the Greenfield Pit found the seams without any parting whatever, with a joint thickness of 5 ft. 6 in., and 6 ft. 10 in.

An average section of the two coals for the whole Whistleberry and Greenfield area is given as:—

		Ft.	In.
SPLINT	HEAD COAL	1	6
	SPLINT COAL	0	9
	PARROT COAL	0	4
	FREE COAL	2	4
Stone		0	3
VIRGIN COAL		2	10

At Hamilton Palace Colliery the section given for the Splint seam is:—

	Ft.	In.
Dark blaes		
FREE COAL	0	3
SPLINT COAL	1	2
Parting	0	1
SPLINT COAL	1	2
GAS COAL	0	8
FREE COAL	1	0
SPLINT COAL	0	3
FREE COAL	1	10
Daugh	0	1
Fireclay		

It is probable that here too the seams are united, and that they are both represented in the above section. At Orbiston Colliery they have been assumed to be in this condition, the joint thickness being 6 feet.

Northwards the intercalation again makes its appearance. At Viewpark the Splint Coal has the section:—

	Ft.	In.
Sandstone	0	10
Calmy blaes	1	0
COAL, free	0	4
" splint	2	4
" gas	0	6
" free	0	5
Daugh	0	6

The Virgin Coal is 1 ft. 7 in. in thickness, with a separation from the last of at least 4 feet. Both the Splint, and the overlying Main and Pyotshaw Coals are in a very inferior condition over an area of about 40 acres, extending from near the Viewpark pits for about 600 yards to the north. This is probably another instance of the calcareous "burning" which has already been referred to.

At Tannochside the Splint seam contains two bands of gas coal—

	Ft.	In.
Fakes	0	5
COAL, free	1	4
" splint	1	0
" gas	0	2
" free	1	1
" gas	0	4
Daugh		

One section gives the Virgin Coal as 2 feet, and the intercalation as 6 feet in thickness. The latter is even thicker at Rosehall, where the combined section is:—

	Ft.	In.
Sandstone		
Blaes	2	0
SPLINT { COAL, splint	2	6
" gas	0	9
" free	0	6
Daugh (holing)	0	6
Bastard fireclay	2	0
Rock	3	0
Fakes	2	6
Blaes	2	6
VIRGIN COAL	2	6
Fireclay		

With regard to the district as a whole, the following points are worthy of comment. The parting between the two seams is greatest in the two northern quarter sheets, but dwindles to nothing in a part of Lanark 11 S.E. Regarded as a separate seam the Splint Coal is thinnest in the southern part of Lanark 11 N.W., and reaches what is perhaps its maximum development near Greenfield and Whistleberry. The presence of a band or bands of gas coal in the upper member seems to be a very general feature in the two eastern quarter sheets. In parts of the Bredisholm field this was formerly used for the distillation of oil. It is said to be very erratic, and where it comes in suddenly it appears to form an addition to the previous thickness of the seam.¹ A curious linear want occurs in the Splint Coal at Douglas Park Colliery. It extends, in almost a straight line, from near Orbiston House, for about three-quarters of a mile to the north-west. It seems never to exceed a chain in width, and is in line with a similar want in Motherwell and North Motherwell Collieries, which will be described in the next chapter (p. 59).

¹ R. W. Dron. "The Coalfields of Scotland," 1902, p. 94.

At Bellshill Colliery there is a thin ferruginous musselband about 3 feet above the roof of the Splint Coal. The interval between the latter and the Humph Coal varies from about $4\frac{1}{2}$ to about 9 fathoms. Where it is greatest it usually includes a large proportion of sandstone.

Humph Coal.—The Humph Coal maintains a workable thickness over about half the district under discussion. Although it is often split by dirt and stone partings, and generally of somewhat inferior quality, it is now rather widely wrought.

At Bogleshole Pit the shaft section is given as 2 ft. 6 in. of coal, with a blaes roof containing ironstone ribs, and a fakes pavement. At the old Orion Pit, near Rosebank Bridge, the section was:—

	Ft.	In.
Blaes	4	0
COAL	0	9
Stone	0	3
COAL	1	6
Fireclay		

The seam was wrought from an “ingoing eye” beneath the old quarry close to Holmhill Farm, to the south of Cambuslang. It is said to be there 3 feet in thickness. At Gateside Colliery it gives the following section:—

	Ft.	In.
Sandstone	2	0
Blaes	1	0
COAL, “craw”	0	2
COAL	0	3
„ splint	0	8
Coaly blaes	0	1
COAL, free	0	3
Coaly blaes	0	1
COAL, free	2	0
Daugh holing		

and at No. 3 Pit, Bothwell Castle Colliery:—

	Ft.	In.
Fakes	0	7
Coaly blaes	0	3
COAL	0	7
Fireclay	0	4
COAL	2	0
Blaes	0	10
Sandstone		

At Blantyre Colliery the seam proved to be rather better near Nos. 2 and 3 Pits than in the previous workings from No. 4. The section in the later workings is:—

	Ft.	In.
Blaes		
Ironstone rib	0	3
Blaes with ironstone	3	0
COAL, free	0	8
Sclitty stone	0	1
COAL, free	1	2
„ splint	1	0
Bastard fireclay		

In the shaft of No. 1 Pit, Whistleberry, the seam is in one division 3 feet thick, with a roof consisting of fakes, and a pavement of faky plies. Two blind bores at Greenfield Colliery gave thicknesses of 2 ft. 5 in. and 2 ft. 8 in. respectively.

All the localities hitherto mentioned lie on the south-west side of a line which runs diagonally across Lanark, 11, from its north-western to its south-eastern corner. To the north-east of this line the development of the coal is in some parts inferior, and it has not yet been wrought.

In the shaft of Hamilton Palace Colliery for instance the thickness is only 13, and at Bellshill Colliery only 14 inches. A bore not far from Tannochside No. 3 Pit found the seam to be 1 ft. 5 in. thick, but foul. At Haughhead Colliery it is as follows:—

	Ft.	In.
COAL	1	4
Dirt	0	10
COAL	0	10

At the Glasgow Colliery Company's Kenmuirhill Colliery the Humph Coal is not considered to be a workable seam. Bores in the Blantyreferme field, however, show it in much better condition, one section being:—

	Ft.	In.
Dark blaes and ironstone ribs		
COAL	0	7
Blaes	0	5
COAL	1	11
Faky fireclay		

This bore was situated near the pithead. Another about half a mile to the south proved a thickness of 2 ft. 1 in. of free coal, with a blaes roof and fireclay pavement. These bores show that the rule given above does not apply without exception, and further information is needed in order to form a decision as to the workable extension of the seam.

The interval between the Humph and the Main Coal is usually 6 or 7 fathoms, but reaches a maximum in the north-western portion of the district, where it consists almost wholly of sandstone. In the Gateside shaft as much as 13½ fathoms of strata intervene between the two seams. The sandstone was formerly quarried in one of the Kirkburn Quarries (south of Cambuslang) and will be further referred to in Chapter VI. (p. 126).

Main and Pyotshaw Coals.—The interval between these seams varies rapidly, and is sometimes as much as 10 fathoms. It is only exceptionally, in this district, that the two come together, or so close as to form a single working subject. They are united, however, in most of the western half of Lanark 11 N.W., as well as in parts of the Viewpark field. Where this is the case, the collective seam is usually known as the Main Coal.

The Main Coal proper is perhaps the most widely wrought at present of all those in this district, while the Pyotshaw is also widely wrought as a separate seam. Both contain in places separable bands of splinty coal, but this is more especially the case with the Pyotshaw, which is in consequence largely selected for blast furnace

use. The Main Coal has more generally the character of a second-class household coal with a white ash. In some places it contains a layer of inferior gas coal locally known as "pugs" which somewhat detracts from its value. The "burning" of this seam in an area near Viewpark has already been mentioned, and we shall come across one or two further instances where the coal has been made useless in a similar way.

The position of the crop is shown by an old day level, which opens on to the Kirk Burn to the south of Cambuslang. The Main and Pyotshaw seams are here in one, with a collective thickness which is stated to be six or seven feet. They are also united in the shaft of Gateside Colliery, though the adjacent workings have more often a section somewhat as follows:—

			Ft.	In.
PYOTSHAW COAL	.	.	2	4
Fireclay	.	.	1	11
MAIN COAL	{ COAL	.	1	10
	{ Parting	.	0	3
	{ COAL	.	1	2

In the Hallside workings both seams are divided by partings, while the separation between them varies from 0 to 30 inches.

At Haughhead Colliery the Main Coal is about 4 feet in thickness, but the upper part of the section is "burnt" in the way referred to above. The alteration also affects the lower part of the Pyotshaw, which is here somewhat thinner than the underlying seam. At Blantyreferme Colliery the Main Coal has been changed into "strains of coaly matter," while there has also been a certain amount of reddening of the roof. This feature is also associated with the calcareous alteration of the coals in a part of the Rosehall field.¹ The local nature of the "burning" at Blantyreferme is shown by the fact that 300 yards north-west of the pit bottom the coal had recovered a thickness of 3 ft. 3 in. The Pyotshaw Coal at this colliery comes 4 fathoms above the Main with a thickness of 2 ft. 4 in.

In Viewpark Colliery, as already stated, the two seams occasionally coalesce, though in other parts of the field they are as much as 7 fathoms apart. The interval is 4 or 5 fathoms at Tannochside No. 3 Pit, but decreases again to the north.

In No. 4 Pit, Blantyre, the gas coal or "pugs" previously referred to come into the section of the Main Coal. At Whistleberry this seam is recorded as 4 ft. 4 in., and the Pyotshaw as 3 ft. 10 in. in thickness, with a separation of rather less than 5 fathoms.

At Hamilton Palace Colliery the Main Coal section is as follows:—

			Ft.	In.
Fakes and sandstone plies				
COAL, free	.	.	1	1
" splint	.	.	0	3
" free	.	.	0	3
Parting	.	.	0	0½
COAL, free	.	.	1	6
" splint	.	.	0	8
" free	.	.	0	7
Fireclay				

¹ See "Econ. Geol. Central Coalfield, Area V.," (*Mem. Geol. Surv.*), 1916, p. 76.

In this field the Pyotshaw is stated to vary from 3 ft. 3 in. to 5 ft. 2 in. in thickness, and to be usually thinnest where it has a sandstone roof. Six or seven inches at the top consist of a very rich house coal, which goes by the name of "yolks." Below this are alternations of splint¹ coal, which extend to the base of the seam. The position is about 3 fathoms above the Main Coal, which is here the first taken out.

The strata between the Pyotshaw and the Ell Coal often contain a large proportion of sandstone. A thin coal and ironstone is found not uncommonly 3 or 4 fathoms above the former seam. This ironstone was formerly used to some extent for ornamental purposes, and was known as the "*Cambuslang Marble*." It was referred to by Ure, writing in 1793,¹ who says, "It is from a few inches to two feet in thickness, and lies in a stratum of till, above the main coal. The ground is a darkish grey, ornamented with white bivalve shells; but sometimes it is reddish. Both varieties take a good polish, and are used in the Marble Manufacture at Glasgow." These statements are repeated in substance in "The New Statistical Account of Scotland," with the following additional information²:—"The stratum of marble already noticed, from 6 to 18 inches thick, is known to extend over a great part of the parish" (of Cambuslang), "and to run into Rutherglen in the direction of Stonelaw. Like other strata of the district it dips towards the Clyde: and wherever coal pits have been sunk, it has been found at the depth of from 180 to 200 feet. At such a depth, it cannot easily be come at; but there is a place on the Kirk-burn, to the south-west of the church, where it has been wrought at several times. . . . Of this marble there is a handsome mantlepiece at Chatelherault near Hamilton, and in the College library at Glasgow; and at Duddingstone, near Queensferry, it has been still more amply made use of." The figures quoted probably apply to the thickness at the old Kirk-burn workings referred to, and the immediate neighbourhood of Cambuslang. In the shaft at Hallside Colliery the seam is given as "Musselbed 10 inches" over 3 inches of coal (see Plate II., Section 3). Bores in the remainder of the district either give a smaller thickness, or fail to record the horizon. The bivalves referred to seem to be a constant feature, and are shells of *Carbonicola aquilina*. It seems improbable that this bed could be of use as an iron ore.

Ell Coal.—This seam is, or was, before it became comparatively exhausted, perhaps the most important house coal of the Central Coalfield. It often considerably exceeds the old measure of length from which its name is taken.³ It reaches its maximum thickness somewhat to the south of Hamilton, and decreases in value from south to north in the area under description.

¹ "The Natural History of Rutherglen and East Kilbride," p. 262.

² Vol vi., Lanark, 1845, pp. 422-3.

³ The Scottish ell is said to have been slightly more than 37 inches in length.

The average section in the Blantyre Colliery workings is given as follows :—

	Ft.	In.
COAL, free	3	4
„ splint	0	2
Fireclay	0	5
COAL (often foul)	1	6
Fireclay		

The thickness is greater at Whistleberry, where we have :—

	Ft.	In.
Faky ribs		
COAL, free	1	4
„ splint	0	1
„ free	0	4
„ splint	0	2½
„ free	1	4
„ splint	0	11
„ free	1	0
Fireclay	0	5
COAL, ribs	0	11
„ free	1	8
Fireclay		

and the seam is even better at Hamilton Palace Colliery, where it is sub-divided as follows :—

	Ft.	In.
Sandstone		
HEAD COAL (free)	1	8
BREAST COAL { free	1	9
{ splint	0	3
{ free	1	5
GROUND COAL (free)	2	3
Fireclay		

There is occasionally a thin parting of sedimentary material between the Breast and Ground Coals, but nothing between the Breast and Head Coals but a divisional plane of ready separation.

The same terminology is used at Douglas Park, East Parkhead, and Bothwell Park Collieries, where however the three divisions of the coal are always separate. The Breast Coal often exceeds 3 feet, while the Head and Ground Coal each vary from about 1 ft. 3 in. to 1 ft. 10 in. in thickness. The maximum parting between the Breast and Ground Coals at Bothwell Park is about 2 ft. 6 in., but that between the Breast and Head Coals swells from 3 inches to 27 feet.

In view of the fact just quoted, there is some ground for doubting whether the Head Coal is included in the Rosehall workings, where the section is :—

	Ft.	In.
Blaes		
COAL	1	8
COAL, wild	0	3
COAL	0	9
Dirt	0	11
COAL	1	1

At Tannochside Colliery the seam was only wrought, on a small scale, from No. 3 Pit, where it had a thickness of 27 inches. At Viewpark the section of old workings is:—

	Ft.	In.
Fakes		
WILD COAL	0	6
COAL	1	10
Strong blaes		

At Blantyreferme Colliery the worked seam is 30 inches thick. This does not include a band of inferior or "craw" coal, often about 17 inches thick, and overlying the former at a distance of from 1 to 15 feet. At Haughhead Colliery the workable portion is 36 or 39 inches thick, with a fairly good roof of faky blaes, and with 15 inches of poor coal or coaly blaes immediately beneath. The latter feature is also present at Kenmuirhill, where the section is:—

	Ft.	In.
Fakes		
COAL, free	0	7
" parrot	0	3
" free	1	9
Coaly blaes and coal	0	10

The seam has been wrought out at the Clyde Iron Works Colliery (Carmyle and Bogleshole Pits), where it was comparatively shallow, and had the section:—

	Ft.	In.
Faky blaes	3	6
Sclit	0	10
COAL, free	1	0
" splint	0	8
" free	0	6
Stone	0	2
COAL	1	6

A band of foul coal occurs here a short distance above the workings, as at Blantyreferme.

The above sections give the impression that the inferior state of the Ell Coal along the northern margin of Lanark 11, is partly due to splitting, and partly to the deterioration of the seam. Where "head," "breast," and "ground" coal can be distinguished, the two latter usually make an excellent house coal, while the "head" coal is generally somewhat inferior.

Strata between Ell and Upper Coals.—A band of ferruginous limestone is known to occur about 3 fathoms above the Ell Coal at Hallside Colliery. It is sometimes as much as 9 inches in thickness, and displays very perfect cone-in-cone structure.

About 6 fathoms higher is a band of "blaes and mussels," which can be traced in a good many bore sections in the district. It lies a short distance below a thin coal, which is only 8 inches thick at Hallside, but is perhaps the one recorded as "gas coal, 1 ft. 4 in.," in the shaft of No. 1 Pit, Hamilton Palace Colliery (*see* Plate II., Section 8).

Between the last horizon and the Upper Coal there is another thin coal seam. It is usually under a foot in thickness, but measures

1 ft. 2 in. at No. 1 Pit, Viewpark (Plate II., Section 4). It is perhaps this seam which is described, in an old bore at Tannochside, as "foul coal, 1 ft. 7 in.," at a distance of two fathoms below the probable representative of the Upper Coal. A "gas coal, 1 ft. 2 in.," overlying 2 inches of free coal, occurs on possibly the same horizon at Hamilton Palace Colliery.

An isolated record of a clayband ironstone 10 inches in thickness occurs in the journal of a bore about a quarter of a mile to the south of No. 4 Pit, Blantyre. The position is 11 fathoms above the Ell, and about 4 fathoms above the musselband already referred to.

Upper, Mossdale, or Wandering Coal.—This seam is sometimes known as the Upper Coal of Glasgow, as it is best developed in the immediate neighbourhood of that city. All the collieries at present working the coal in this district lie within a radius of seven miles from Glasgow Green. To the east of this it thins, and southwards it becomes unrecognisable with any certainty. Even in the worked area it is not of first class quality, and the pavement is generally a "bastard" fireclay, so hard that it is necessary to make the holing in the coal itself.

The seam was formerly wrought at the Orion Pit, close to Rosebank Bridge. Here the section was :—

	Ft.	In.
Fireclay		
COAL, foul	0	4
" clean	1	6
Rib	0	2
COAL	1	0
Rib	0	1
COAL	1	5

At Gateside Colliery :—

Blaes		
COAL, "craw"	0	4
Fireclay	0	6
COAL, free	2	3
" parrot	0	1

At Westburn Colliery the seam as a whole is thicker, with a parrot layer at the base which is somewhat more pronounced. At Dechmont the total thickness is 3 ft. 4 in., with a 1-inch parting somewhat below the middle of the seam. At Haughhead Colliery the coal varied from 29 to 34 inches in thickness, but the roof was of blaes, and the workings very wet, perhaps in consequence of water carried by a thick sandstone a short distance above. At Blantyreferme the seam is still worked, with the section :—

	Ft.	In.
Blaes roof		
Fireclay	3	0
COAL	2	0
" wild	0	7
Fireclay pavement		

At Bredisholm No. 3 Pit (just north of Lanark 11 N.E.) the seam was opened up a few years ago, and has proved to have a section very similar to that of Blantyreferme. In the bore near Tannochside, referred to under the last heading, the thickness is probably 1 ft

6 in., though there is some doubt as to the identification. In another bore near Tannochside New Buildings, the section is certainly as follows:—

	Ft.	In.
Blaes and iron ribs		
COAL	0	4
Fireclay	0	2
COAL	1	8
Blaes	0	4
Fakes and sandstone		

In the shaft of No. 1 Pit, Viewpark, the position is equally certain, and the coal measures 20 inches.

In the southern part of the district, as already stated, the position of the seam cannot be recognised with confidence. The supposed representative at Hamilton Palace Colliery lies about 18 fathoms above the Ell (Plate II., Section 8), and has a section as follows:—

	Ft.	In.
Black blaes		
Foul shale	0	7
COAL	0	2
Fireclay	1	3
COAL	0	8
Black shale	0	5
COAL	0	7
Fireclay	0	9
COAL	0	6

At Whistleberry a possible equivalent has the section:—

	Ft.	In.
COAL	0	4
Stone	0	2
COAL	1	0

but the seam may perhaps as probably occur some 3 fathoms lower, with a thickness of 13 inches (*see* Plate II., Section 6).

Two bores in the Blantyre field show the Upper Coal to consist of 6 and 9 inches of foul coal respectively. It is thus rather curious that the coal was wrought at the old Letterick Colliery only half a mile north-west of High Blantyre. There were here 24 inches of clean coal, but the seam included two partings, and 4 inches at the top were described as foul.

The Palaceraig Blackband Ironstone is not known with certainty to occur in the present area. Its position may, however, be represented by a 16-inch musselband ironstone, occurring about 8 fathoms above the supposed Upper Coal in the shaft of Hamilton Palace Colliery. A 16-inch "limy ironstone" is also recorded, about 7 fathoms above the Upper Coal, in a bore slightly west of Haughhead Colliery. The section reads:—

	Ft.	In.
Faky ironstone	0	2
Soft parting	0	1
Faky ironstone	0	5
Blaes	0	5
COAL	0	3
Blaes	1	2
LIMY IRONSTONE	1	4

A bed of coal 25 inches in thickness was cut at a height of 11 fathoms above the Upper Coal in a bore near Tannochside New Buildings. A further musselband, not described as ironstone, occurs about 15 fathoms above the supposed Upper Coal at Hamilton Palace Colliery, 8 fathoms above the musselband previously referred to. It is directly overlain by a 16-inch gas coal. The bed would seem to have a certain persistence, as it is represented in at least one bore about half a mile away.

Other thin coals occur erratically in the interval between the Upper Coal and the base of the Barren Measures, but there is seldom anything which exceeds a foot in thickness.

Barren Measures.—Although thin beds of coal do occur in the lower part of these measures, there is, as the name implies, no seam of coal or ironstone which is likely to be of much economic value. Taking the base of the series as lying 50 fathoms above the Ell Coal, there must be about 160 fathoms of Barren Measures present in the deepest part of the basin. They consist to a large extent of reddish sandstones, some of which have been extensively quarried (*see* pp. 125–129). These sandstones are usually soft, sometimes rather coarse in grain, and blotched in places with streaks and spots of a deep red colour. Not infrequently they contain hard red concretions, up to several yards in length, in which the sand grains are cemented by lime carbonate. Alternating with the sandstones are thick beds of marl or clay, usually described in journals as “fireclay.” A limestone of a compact and usually unfossiliferous type, which is known in other localities to occur not uncommonly in the Barren Measures, is well seen in the South Calder south-west of Orbiston House, and is several feet in thickness. These limestones have not the persistent character of true marine horizons, and do not form good index beds.

Unfortunately our knowledge of these high measures is very incomplete, partly because few complete records of shaft sections of the deeper pits have been preserved. They include types such as the marl referred to, not usually met with in the better known Productive Measures. This fact has led to a confusion of nomenclature, but even allowing for this, it is probable that the series is unusually variable, both as regards colour and mineral composition. It is interesting in this connection to compare the journals of No. 3 Pit, Bothwell Castle Colliery (*see* Plate II., Section 5), and of a bore already referred to near Haughhead. The two localities are only a mile and a half apart. In the former, no red beds are mentioned at a less distance than 53 fathoms above the Upper Coal; in the latter, the coloration begins within 8 fathoms of the same coal seam.

The journals just mentioned are the only two in the district which record a limestone above the Upper Coal. At Bothwell Castle the section is:—

					Ft.	In.
Limestone	.	.	.	.	0	6
Dark blaes and fakes	.	.	.	.	7	6
COAL	.	.	.	.	0	2

about 35 fathoms above the coal seam mentioned. At Haughhead, in a position 24 fathoms above the coal we read:—

	In.
Limy fake	7
Dark limestone	5
Soft coaly blaes	10
Light calmy limestone	7

It is uncertain whether in either case the limestone represents Skipsey's Marine Band, which is taken as the base of the Barren Measures, and whose importance as an index horizon will be further indicated (p. 66).

A group of coals of rather unusual thickness are given in the journal as occurring from 29 to 36 fathoms above the Upper Coal in the shaft of No. 1 Pit, Viewpark Colliery. The particulars are:—

	Thickness.		Height above Upper Coal.
	Ft.	In.	Fms.
COAL	2	0	36
"	1	3	32
"	3	4	29

The nearest approach elsewhere to such a thickness of coal at this horizon occurs a short distance above the limestone in the bore at Haughhead already referred to. Here we have:—

	Thickness.		Distance above Upper Coal.
	Ft.	In.	Fms.
COAL	1	2	32
" (soft foul)	1	8	29
" (foul)	1	5	26
Limestone			24

An 18-inch coal has been worked a little at the crop, on the south side of the North Calder Water, just west of the Rosehall Railway bridge. Its position is believed to be about 30 fathoms above the Upper Coal, and it may belong to the same group, which, however, can hardly be traced in any other section in the district.

In Bredisholm No. 3 Pit a coal occurs about 47 fathoms above the Upper, and gave the following section in one exposure:—

	Ft.	In.
COAL	0	5
Fireclay and silt	0	4
COAL	1	1

The shaft section of this seam appears to have been 23 inches of coal without any parting.

A mottled purplish marl or fireclay, very high in the Barren Measures, was formerly quarried at the Hallside Terra Cotta Works, about three-quarters of a mile to the east of Hallside Steel Works. The quarry face showed 10 to 20 feet of surface material, including some brick-clay. This rested on a coarse sandstone overlying the marl referred to. The bed itself was 10 feet in thickness, and was used for the making of wire-cut bricks. It rested in turn on a quarried sandstone, which will be further referred to in Chapter VI. (p. 129).

General Structure.—Although modified very largely by faulting, the general structure of the district is that of a deep irregular basin. This depression was previously termed the "Uddingston Syncline,"¹ but, in view of the irregularity, it may be more correct to name it the Uddingston Basin.

The deepest part of the basin has, it is true, an elongated outline, and stretches from Hallside in an E.S.E. direction as far as Bothwell. The maximum depression is near Hallside Colliery, in the shafts of which the Upper Coal occurs at 197, and the Splint Coal at 241 fathoms. From this point the strata rise rapidly to the north and west, and even more steeply to the south-west, on which side the large Dechmont Fault is soon encountered. The inclination amounts to 1 in 3 in the last case mentioned. The rise to the west soon flattens out, and we pass in this direction into a much shallower trough or syncline, forming a continuation of the Rutherglen syncline which has already been referred to. The axis of this secondary structure runs east and west near Bogleshole, and the rise on the south side is strong enough to bring the Splint Coal to the surface some distance to the north of the Dechmont Fault.

In the two eastern quarter sheets the dips are on the whole rather gentle, and almost uniformly to the south or west. The fact that the seams become shallower on the south side of the basin is here due, not to any contrary rise, but to the Bothwell and Whistleberry Faults, which will be described in the sequel.

The horizontal section (Fig. 2, p. 4) crosses the deepest part of the basin in a N.N.E. direction. It shows the actual dip of the strata and the effect of the Haughhead and Dechmont Faults.

Dechmont Fault.—This fault, which has already been repeatedly referred to, is by far the largest in the present district. Near Loanend strata 150 fathoms above the Splint Coal are brought on a level with lavas some distance down in the volcanic group of the Calciferous Sandstone Series. The most probable estimate of the amount of throw is here about 600 fathoms. The strata are usually found to rise as the fault is approached from the downthrow side, and it is also stated that there is an increased "draw" or tendency for the surface to be affected beyond the limits of underground workings. Near Loanend the line of fracture makes a sudden bend from N.N.W. to nearly east and west. The reasons for this alteration need not here be discussed.²

Among smaller dislocations are three with courses nearly east and west, for which the names Haughhead, Bothwell, and Whistleberry Faults, are here suggested. The first of these begins close to the river Clyde, a little above Rosebank Bridge. Passing Carmyle it has attained a downthrow, to the north, of about 22 fathoms, which gradually increases to 40 at Haughhead Colliery, and about 45 fathoms in the Rosehall field. It is well exposed in the North Calder Water, a short distance below Rosehall Bridge. Both in the Haughhead and in the Rosehall workings the inclination of this fault is unusually low, the angle with the horizontal being less than 45°.

¹ "The Geology of the Glasgow District" (*Mem. Geol. Surv.*), 1911, p. 164.

² See "The Geology of the Glasgow District" (*Mem. Geol. Surv.*), 1911, p. 170.

The *Bothwell Fault* runs a parallel course about two miles farther south. It is probably continuous in line with the east and west part of the Dechmont Fault, but has a throw (down to the north), of only about 28 fathoms, where it leaves the latter. Near Blantyre Station it has been crossed in an exploring mine; it has here the form of a close succession of small "hitches," with a total northward downthrow of 43 fathoms. About half a mile to the east the amount has increased to 80 fathoms. The surface position of the fault appears to lie just south of the Clyde, where the latter is joined by the Park Burn, and from this point it runs due east to the margin of Lanark 11, which it crosses probably to the north of the Logans plantation.

From Hamilton Palace Colliery, as far as the mine referred to, this fault has also an unusually low inclination, the main division at the latter point being inclined at only 30° to the horizon. At Loan-end, however, it is more nearly vertical. Perhaps the low inclinations referred to, as well as the lateral variation just mentioned, may be due to tilting of the fault planes, at a period subsequent to their formation, by the movement that caused the general dip of the strata in this part of the district from north to south.

The *Whistleberry Fault* follows a somewhat curving course a little to the south of the one last described, with which it appears to unite about a quarter of a mile south of Orbiston House. Its greatest throw is about 68 fathoms. The plane was cut in a blind bore in Craighead Colliery, and gave rise to an outburst of gas and water, which choked the bore hole with rock fragments for a distance of 25 feet.

Whinstone Dykes.—North-western whinstone dykes, or "gaws," cross the coalfield near Newton, Craighead House, the north of the town of Hamilton, and Rosehall Colliery. They are not of great thickness, and their surface exposures are covered by superficial deposits. Where specimens have been collected underground, the rocks were in too decomposed a state to admit of satisfactory petrological determination. It seems impossible therefore that they can be of any use as sources of road metal. Unfortunately they burn and spoil to some extent the coals they intersect.

The Newton dyke has a thickness of 5 feet in the Ell Coal seam at Westburn Colliery. On the Main Coal level the thickness is stated to be 22 feet. Burnt coal extends in the former case to 6 feet, and in the latter to 10 feet from the margin. The Craighead dyke varies from a few feet up to 40 feet in width. It gives off lateral sills or "floats" into every seam yet worked, which it encounters, but fortunately only on a small scale. They do not extend as a rule so far as two chains from the parent intrusion.

Possible Reserves of Coal.—The thicknesses of the various seams have been carefully tabulated in areas where they have not yet been wrought. In particular, attention has been drawn to the possible reserve of Blackband Coal. At the time of the Survey revision there was an area to the north of Uddingston in which none of the coal seams had yet been developed. It is likely, however, that inroads in the thicker seams have since been made.

The coals have also been left intact in some of the troubled ground along the Dechmont Fault. It would, however, be difficult

to work them. So far as is known, none of the lower seams have yet been worked in the comparatively shallow area to the south of Cambuslang. Their condition here may be guessed at from the records in the blind bore at No. 2 Pit, Gateside, which has several times been quoted. We may recall the fact that the Blackband Coal is here 2 feet in thickness, including two partings of slitty coal, each measuring an inch. The Virtuewell is in two leaves, 18 and 20 inches thick respectively, with a separation of about a fathom. The main division of the Kiltongue Coal only measures 18 inches, while the lower Drumgray is in two leaves, 20 and 16 inches thick, with 4 ft. 6 in. of strata between them.

These figures may be compared with those in a bore at Whitlawburn, in Lanark 10 N.E., on the opposite side of the area in question. What is in all probability the Blackband Coal has here the section :—

					Ft.	In.
CoAL	.	.	.	.	0	11
Coaly blaes	.	.	.	.	0	11
CoAL	.	.	.	.	1	2

The Virtuewell is very poorly represented. The top leaf of the Kiltongue Coal, however, measured 1 ft. 11 in., and this seam was largely wrought at Wellshot Colliery, only a little to the north. While these data show nothing of great value, a bore in the area referred to would at least be of interest.

C.T.C., J.S.G.W., E.M.A.

CHAPTER IV.

COAL MEASURES.

Mossend, Motherwell, Cleland, and Newarthill.

A. DISTRICT OF MOSSEND AND MOTHERWELL.

(Lanark, 12 N.W., S.W.)

OVER a large part of this district the surface formation consists of Productive Coal Measures, but the overlying Red or Barren Measures are also present. The latter occur in three separate areas, bounded in part by large faults. The largest extends along the western boundary of the district, and is continuous with the still larger area of these measures brought down by the Uddingston Basin. Over much of the area, however, the coals lie at shallow depths, and have been worked for so long that only the thinner seams are now usually available.

The collieries raising coal in the district in 1916 were nineteen in number, giving employment to between 6000 and 7000 men. Various pit and bore sections in the two quarter-sheets are drawn up graphically in Plates IV. and V. The following sequence may be taken as an average for the Coal Measures of this district, but there are many local variations.

GENERAL SECTION OF COAL MEASURES OF DISTRICT OF MOSSEND AND MOTHERWELL.

	Thickness.			Depth.		
	Fms.	Ft.	In.	Fms.	Ft.	In.
Strata, with reddish coloration (Upper or Barren Measures) containing a few thin coals	99	5	6	99	5	6
SKIPSEY'S MARINE BAND (hard limestone)	0	0	6	100	0	0
Strata, not mainly red in colour, with thin coals	35	4	6	135	4	6
PALACECRAIG BLACKBAND IRONSTONE (impersistent)	0	1	6	136	0	0
Strata	6	4	10	142	4	10
UPPER COAL (impersistent)	0	1	2	143	0	0
Strata, with thin coals	15	4	0	158	4	0
ELL COAL (with partings)	1	2	0	160	0	0
Strata, including an impersistent Musselband	8	3	0	168	3	0
PYOTSHAW COAL	0	3	0	169	0	0

	Thickness.			Depth.		
	Fms.	Ft.	In.	Fms.	Ft.	In.
Strata	5	2	0	174	2	0
MAIN COAL	0	4	0	175	0	0
Strata	6	4	8	181	4	8
HUMPH COAL	0	1	4	182	0	0
Strata	4	1	9	186	1	9
SPLINT COAL	0	4	3	187	0	0
Strata	1	1	9	188	1	9
VIRGIN COAL	0	1	3	188	3	0
Strata	6	4	6	195	1	6
MUSSELBAND COAL	0	1	6	195	3	0
Strata	7	4	0	203	1	0
BLACKBAND COAL	0	2	0	203	3	0
Strata	8	1	0	211	4	0
VIRTUEWELL COAL	0	2	0	212	0	0
Strata	5	5	0	217	5	0
LADYGRANGE COAL	0	1	0	218	0	0
Strata	5	5	0	223	5	0
KILTONGUE MUSSELBAND, SHALE, IRON- STONE, etc.	0	1	0	224	0	0
Strata	4	4	6	228	4	6
KILTONGUE COAL (replaced locally by KENNELBURN BLACKBAND IRONSTONE and Shale) 1 ft. to	0	1	6	229	0	0
Strata, with Musselband near base	7	4	3	236	4	3
UPPER DRUMGRAY COAL	0	1	9	237	0	0
Strata, with occasional thin coal	8	4	3	245	4	3
LOWER DRUMGRAY COAL	0	1	9	246	0	0
Strata	11	4	9	257	4	9
BALMORAL (MILL) COAL	0	1	3	258	0	0
Strata	17	0	0	275	0	0
? Base of Coal Measures				275	0	0

Except possibly in the north-eastern corner of the district, no strata come to the surface which are lower than the Lower Drumgray Coal. The number of bores sunk below the Balmoral Coal is comparatively small. Skipsey's Marine Band is well exposed both on the north and south side of Motherwell, but its distance above the Ell Coal is variable. The maximum thickness of the Barren Measures above it is probably not more than 100 fathoms.

Balmoral Coal and underlying strata.—Neither the Balmoral nor any lower coal is known to have been worked in this district. In a deep bore near Woodhall Cottage 29 inches of coal appear to have been recorded in the Balmoral position, though the correlation is not certain, and in any case the coal is much thinner (9 inches) in another bore about a quarter of a mile to the west. In the Thankerton field a 12-inch coal has been found by boring at a depth of about 9 fathoms below the Lower Drumgray. It is locally believed to represent the Shotts Gas Coal, but seems more likely to be the Balmoral. A blind bore in Milnwood No. 1 Pit gives the following section:—

	Fms.	Ft.	In.
Hard fakes	1	5	4
Fireclay	0	0	2
COAL	0	1	4
Blaes	0	0	10
Fakes	0	1	3

The coal is almost certainly the Balmoral which is also recorded (as the Mill Coal) in a bore in Biggins Farmyard, with the section below (*see* Plate V., Section 2):—

	Ft.	In.
Ironstone rib	0	2
Dark blaes	0	9
COAL	1	3½
Sandstone	3	4

In Coursington (Dalzell) Colliery a blind bore gives the following section for a coal which is believed by the writer to occupy the same horizon (*see* Plate V., Section 8).

	Ft.	In.
Sandstone	0	3
Blaes and balls	2	2
COAL	1	11
Fireclay	0	10
Fakes	1	0

This coal was taken to be the Lower Drumgray, and sunk to on this supposition, but proved too poor to work. Bores in No. 2 and No. 4 Pits, Motherwell Colliery, show no coal more than a foot in thickness, that can represent the Balmoral on any hypothesis.

It is unlikely that there is any workable seam lower than the Balmoral in this district, so far at least as Coal Measures are concerned. The bore near Woodhall Cottage continues for 60 fathoms below the supposed Balmoral Coal without finding another which is above a foot in thickness. The bore from No. 4 Pit, Motherwell, shows no coal exceeding 16 inches in a vertical distance of 37 fathoms below the position which was sunk to at Coursington.

It should be noted that, for the purposes of this Memoir, the Balmoral Coal means the Balmoral Coal of Coatbridge, which is equivalent to the Jenny Peat Coal of Auldshields, the Clefted Coal, and the Blackhall Parrot, while it is most extensively worked as the Mill Coal of Armadale. The Balmoral Coal of Slamannan is a higher horizon, perhaps equivalent to the Shotts Gas.

Shotts Gas Coal.—This coal has been worked a little at Lauchope, in the north-eastern corner of the district under description. Its depth was 3 fathoms below the Lower Drumgray, and the section as follows:—

	Ft.	In.
Faky blaes	3	0
Soft blaes	1	2
GAS COAL	0	5
ROUGH COAL	1	1
Blaes, with nodules		

In some parts of the workings a musselband was found just above the seam. The latter is not known to attain a thickness of a foot anywhere else in the district, except possibly at Thankerton, where, however, as already stated, we regard the supposed Shotts Gas as being more probably the Balmoral.

Lower Drumgray Coal.—In 1916 this coal was only wrought in the northern part of the district. Generally speaking, the depth is

greater in the southern portion, and the thickness is less. Nevertheless there can be little doubt that its working area will be extended, as the quality is that of a good household coal.

At Hattonrigg Colliery the Lower Drumgray averages 23 inches in thickness, with a blaes roof and a fireclay pavement. It is claimed as an excellent house coal. In the Woodhall field the worked section is as follows:—

	Ft.	In.
Kingle		
Blaes	3	0
COAL	2	7
Fireclay		

In the workings at Lauchope the section is:—

	Ft.	In.
Blaes	3	6
Black blaes	0	6
COAL	2	6
Hard fireclay		

In Holytown No. 12 Pit (close to No. 5 Pit, *see* Plate V Section 5) the coal face shows an average section of 2 feet, with a clay roof. The seam is here rather “gassy.”

The following figures and sections refer to localities where the seam is still unwrought.

Milnwood Pit:—

	Ft.	In.
Hard sandstone	1	4
Blaes	0	6
COAL	2	2
Fireclay	1	6
Sandstone	0	10

Biggins Farmyard Bore:—

	Fms.	Ft.	In.
Soft sandstone	1	5	11
COAL	0	1	9
Fireclay	0	0	4
Grey fakes and sandstone	0	4	10
Depth from surface 63 fathoms.			

No. 3 Pit, North Motherwell:—Thickness 1 ft. 9 in.

No. 4 Pit, Motherwell:—

	Ft.	In.
Blaes	3	6
Ironstone	0	2
Blaes	2	4
COAL	1	1
Coaly ribs	0	6
Sandstone	1	0

No. 2 Pit, Motherwell:—

	Ft.	In.
Sandstone	4	0
Blaes with ironstone balls	1	8
Blaes	1	0
COAL	1	8
Fakes and sandstone plies	1	1

Coursington (Dalzell) Colliery :—21 inches of coal with blaes roof and fireclay pavement. The coal is stated to be of a hard splinty nature, and partly for this reason has been taken for the Upper Drumgray. The reasons stated below are, however, so strong that it is probably the lower seam.

No. 1 Bore Motherwell, near Parkneuk Ironworks :—Thickness 11 inches, at a depth of 128 fms.

At Belhaven (Over Johnston) Colliery, a coal which is considered to be the Lower Drumgray has been found at a depth of rather more than 29 fathoms below the Virtuewell. Farther north the seam has a workable, or almost workable thickness, in different collieries just east of the area under description. (*See* p. 84).

Occasionally a thin representative of the Mid Drumgray Coal is met with in this district, but it is nowhere a workable subject.

Upper Drumgray Coal.—In the year 1916 the undoubted Upper Drumgray Coal was being wrought at Thankerton and Lauchope Collieries. It had formerly also been wrought at Legbrannock. All three localities are in the north-eastern part of the district. This seam has the general character of a hard splinty coal, contrasting strongly in this respect with the one last described. A section recorded in the Lauchope workings is as follows :—

	Ft.	In.
Faky sandstone		
Blaes	0	7
COAL	2	6
Fireclay		

In the old workings at Legbrannock Colliery, somewhat farther to the south, the average section is 2 ft. 3 in. In the Thankerton field the Upper Drumgray seems to be thickest close to the shaft-bottom of No. 6 Pit, where it reaches 18 inches, or even 2 feet.

In Motherwell Colliery a coal which is worked under the name of the Kiltongue is believed after consideration to be more probably the Upper Drumgray seam. The reason for this conclusion is the depth of the coal below the Kiltongue Musselband, which is about 12 fathoms, as compared to from 4 to 7 fathoms, in the adjoining districts, for the Kiltongue Coal proper. In the same way, from comparison of the blind bore at Coursington (Dalzell) Colliery, with a similar bore in No. 3 Pit, Cleland Colliery, where the seams can be identified with confidence, it appears to be probable that the coal wrought as the Kiltongue in the former locality is in reality the Upper Drumgray (*see* Plate III., Section 8, and Plate V., Section 8). This conclusion has been tentatively come to, in spite of the fact that the "Kiltongue Coal" of Coursington is a free coal, and a lower one, as stated above, is said to be of a splinty nature.

The "Kiltongue Coal" is here 2 ft. 1 in. in thickness, and is underlain by another measuring 13 inches, at a distance of about a fathom.

It is to be feared that in much of the remainder of the district the Upper Drumgray Coal is not thick enough to be workable under present conditions, but the following sections will show its local variations.

Localities in Lanark 12 N.W. :—

Bore at Unthank Farm (Plate V., Section 1) :—

	Ft.	In.
Faky sandstone	3	6
Blaes	0	8
CoAL	1	2
Fireclay	2	0
Fakes and fireclay	2	2

Blind bore in No. 1 Pit, Milnwood. Thickness, 11 inches.

Bore at Biggins Farmyard (Plate V, Section 2) :—

	Ft.	In.
Sandstone	2	2
Blaes	0	10
CoAL	1	7
Fireclay (soft)	0	8
Fireclay	3	4

Bore 800 ft. N.N.E. of Woodhall Cottage. Position $8\frac{1}{2}$ fathoms below Kennelburn Seam :—

	Ft.	In.
Fakes	1	2
Blaes	1	7
CoAL	1	7
Fireclay	2	8
Fakes and plies		

No. 12 Pit, Holytown :—

	Ft.	In.
Dark fakes with ribs	6	0
CoAL	1	5
Fireclay and daugh	1	0
Sandy fireclay	1	6
Sandy fakes		

Localities in Lanark 12 S.W. :—

No. 3 Pit, North Motherwell (Plate V., Section 6). Thickness, 2 feet.

No. 1 Bore, Motherwell, near Parkneuk Ironworks (Plate V., Section 7). Thickness, 11 inches.

No. 2 Pit, Motherwell :—

	Ft.	In.
Sandstone		
Fakes and blaes	1	4
CoAL	1	2
Fireclay	0	2
CoAL	0	8
Fireclay	0	1
CoAL	0	2
Fakes and Fireclay	2	4
Sandstone		

No. 4 Pit, Motherwell :—

	Ft.	In.
Sandstone	1	10
Fakes	1	6
CoAL	1	11
Fakes	0	10
CoAL	0	2
Fakes	1	6
Sandstone		

No. 2 Pit, Camp Colliery. Thickness, 1 ft. 4 in.
Bore near Carfin village. Thickness, 1 foot.

In preparing the tables of thicknesses, for this and the previous seam, it has been assumed that the "Kiltongue" of Coursington and Motherwell Collieries is really the Upper Drumgray Coal. The question affects the reading of some of the bore sections from which the information is obtained.

The musselband which occurs so frequently above the Upper Drumgray Coal, in other parts of the Central Coalfield, has been met with in only one or two localities in this district. At Lauchope the blaes just above the coal contains abundant "mussels," and about 5 feet higher is a thin parrot shale, with a 4-inch blackband ironstone, also containing this fossil. "Mussels" also occur, at two similar levels, in one part of the Hattonrigg mine roads.

Kiltongue Coal and Kennelburn Ironstone.—The Kiltongue Coal of this district is generally thin and of inferior quality. The only colliery which was working what we believe to be the Kiltongue in 1916 was Hattonrigg, although, as has been seen, a supposed Kiltongue Coal was also worked at Motherwell and Coursington. In the north-western corner of the district, at Woodhall, and near Lauchope, a seam corresponding to the upper part of the Kiltongue Coal was formerly worked as the "Kennelburn," and in this part of the area includes a blackband ironstone. In the old workings, from No. 1 Pit, Woodhall, the section was as follows:—

	Ft.	In.
Fakes, roof		
Blaes	0	3
FREE COAL	0	4
GAS COAL	0	5
Scrit	0	4
Shale	1	10
IRONSTONE (inferior)	1	1
Scrit	0	6
Fireclay	0	6
COAL	1	5
Faky blaes		

The seam is partly exposed in the stream 700 feet north-west of Lauchope, where the following items were recorded:—

	In.
COAL	2
GAS COAL	5
Parrot shale	8
PARROT and IRONSTONE RIBS	6

The section is, however, incomplete. In the Hattonrigg workings the average section is:—

	Ft.	In.
Sandstone roof		
Fakes (brushing)	3	6
Wild Coal ("dugger")	0	4
COAL	2	3
Daugh	0	8

In the Unthank Farm bore (Plate V., Section 1), about a third of a mile east of the Hattonrigg pits, the development is much poorer,

and the same applies to a blind bore in No. 1 Pit, Milnwood. In the latter locality the coal is in two leaves, separated by three feet of fakes and fireclay. The bottom leaf is the thicker, but only measures a foot. The Biggins Farmyard bore recorded the coal as in one leaf, 16 inches thick.

In a bore in No. 2 Pit, Motherwell, a bed of "mussels," which is taken to be the Kiltongue Musselband, lies 10 fathoms below the Virtuewell, and 7 fathoms above a coal which gives the following section:—

	Ft.	In.
COAL	1	0
Fireclay	0	2
COAL	0	2
Fakes and fireclay	1	9
COAL	0	9

This is the coal which we take to be the true representative of the Kiltongue. For similar reasons we incline to the view that a 13-inch coal found in the blind bore at Coursington, about 10 fathoms above the so-called Kiltongue, is the true equivalent of that seam (see Plate V., Section 8).

At Belhaven (Over Johnston) Colliery, the Kiltongue Coal is said to have the following section:—

	Ft.	In.
COAL (inferior parrot)	1	5
Dirt	0	10
COAL	0	7

A want occurs in the Kiltongue coal in Hattonrigg, No. 4 Pit, which does not appear to be due to a "wash-out." There is, on the other hand, good evidence of low-angled lines of movement, the sides of the want being glazed and "lipey," while the blaes near the edge has its lamination sometimes sharply twisted. The coal just outside the want is often a foot or so thicker than usual.

Kiltongue Musselband Shale and Ironstone.—This seam does not appear to be of any economic value in the district, but is often a useful index-bed for the identification of the lower seams. Its average distance above the Kiltongue coal varies, as already stated, from about 4 to about 7 fathoms. In one or two localities a thin coal occurs a short distance below the Musselband. A blind bore at Legbrannock records two ribs of ironstone, the upper 5½ inches and the lower 2 inches in thickness, in the Musselband position. The distance apart is about a foot, and a foot below the lower band is a 5½-inch coal.

Two musselbands are recorded near this horizon in the journal of No. 12 Pit, Holytown. (See Plate V., Section 5.) The upper is only an inch in thickness. It rests on a 3-inch coal, and lies 3½ fathoms above the lower band, whose section is as follows:—

	Ft.	In.
SHALE (good)	0	8
Shale	1	0
Musselband	0	8
IRONSTONE	0	4
COAL (rough)	0	2

Ladygrange Coal.—A thin coal occurs in this district about the same distance below the Virtuewell as the seam wrought under the name of the Ladygrange near Longriggend and Slamannan. By comparison of a chain of graphic bore sections, it has been shown that the two are probably identical. As far as is known, the seam has not been wrought anywhere in the district, and it is generally much too thin to be workable. In the northern quarter-sheet, however, it attains, though somewhat irregularly, a development of over a foot.

In a cross-cut in Woodhall No. 1 Pit, for instance, the coal, which is here $7\frac{1}{2}$ fathoms below the Virtuewell, has the following section:—

	In.
COAL	4
Sandy fireclay	10
COAL	10

In the journal of a blind bore in the old Garden Pit, which lies half a mile farther west, the thickness is recorded as 18 inches (see Plate V., Section 3), while the roof and pavement are both described as fakes. Two similar bores in the Legbrannock field give thicknesses of 13 and 18 inches respectively. In the Unthank Farm bore the seam was found to be again in two leaves, a foot and 13 inches thick, and separated by 2 ft. 8 in. of fakes and blaes. (See Plate V., Section 1). There were also two leaves in the shaft of No. 12 Pit, Holytown, the upper being 5 inches, and the lower 13 inches in thickness, with a separation of 1 ft. 10 in. of fireclay.

Virtuewell Coal.—In the year 1916 this seam was being raised at nine collieries in the district, and it is known to have been formerly worked in other five or six. It rarely much exceeds three feet in thickness, and is usually ranked as a second-class household coal. It appears, however, to be generally rather thicker in the southern than in the northern quarter sheet. In some localities a parrot shale occurs in the roof, and was formerly used for the distillation of oil. A little above the shale comes the position of the Newarthill, or Cleland, Roughband Ironstone,—an unusual type of clayband—which is frequently recognisable, and in one case, at least, was formerly wrought.

In the Woodhall workings the average section is:—

	Ft.	In.
Sandstone		
Sandstone and blaes	3	6
Blaes	0	5
COAL	1	10
Fireclay		

In the Holytown field the thickness is greater, while the overlying shale forms a convenient roof to the roads. The section is:—

	Ft.	In.
Shale		
Fakee (brushing)	3	0
COAL	2	8
Daugh	0	10

Four and a half feet above the coal occurs a 4-inch ironstone—the Roughband already referred to. This band was also in evidence in the now abandoned Carfin workings, where one section was:—

	Ft.	In.
Freestone		
Fireclay	1	0
IRONSTONE	0	5
Blaes	0	5
Shale	0	5
Blaes	0	6
Fireclay	0	5
COAL	2	10

Another section gives 8 inches of ironstone, at a somewhat greater distance above the coal. An old kiln, in which the ironstone was calcined, is still standing.

In the Johnston field of the United Collieries, Ltd. (including Over Johnston, Middle Johnston, and Nether Johnston Collieries), the ironstone appears to be usually thicker. The section is given as:—

	Ft.	In.
Black blaes		
ROUGHBAND IRONSTONE	1	0
Faky Fireclay	1	2
Shaly Blaes	0	10
COAL	2	6
Fireclay		

In Coursington (Dalzell) Colliery the coal is 33 inches in thickness, and is divisible as follows:—

	Ft.	In.
COAL, free	0	7
„ splint.	0	8
„ free	1	6

The shale occurs immediately above, and the Roughband overlying this is a foot or more in thickness. The latter is here, as usual, a calcareous clayband (*see* p. 77), and at the time of the revision of the geological maps lay in the bings in massive rough-surfaced blocks. It is also conspicuous at the adjoining Parkhead Colliery, where the horizon contains scattered mussels, while the coal has much the same thickness as at Coursington.

In the Hattonrigg and Milnwood fields the coal is thinner, and has not up to the present been wrought. In Hattonrigg Colliery its thickness is only 17 inches, but in the neighbouring Unthank bore the section is:—

	Ft.	In.
Fakes and sandstone	0	11
Blaes	0	8
COAL	1	8
Parting	0	1
COAL	0	2
Fireclay and balls	1	9
Fakes	3	9

In the blind bore in No. 1 Pit, Milnwood, the thickness is somewhat similar, but that in the Biggins Farmyard bore is not quite so great:—

	Ft.	In.
Fakes	1	0
Light fireclay	0	8
Dark blaes	0	2
COAL	1	6
Fireclay	1	4
Light fakes and sandstone		

Blackband Coal.—The Airdrie Blackband was wrought as an ironstone, at the old March Pit, Carnbroe, less than half a mile to the north of the ground under description. It is here sandwiched between two layers of coal, of which the lower is more than two feet in thickness. Between this point and the old Garden Pit, about half a mile to the west of Woodhall, the ironstone has ceased to exist as a workable subject. The section in the latter reads:—

	In.
COAL ("craw")	4
IRONSTONE	3
COAL	1

The ironstone dies out altogether to the west and south, but the coal recovers its thickness. The latter had not been worked in the present area until comparatively recently, and is still largely *in situ*. In 1916, however, it had been opened out in the large majority of the collieries of this district. Its distance below the Splint Coal varies from 12 to 20 fathoms.

The coal is usually divided into several leaves, of which the lowest is the thickest. The total thickness rarely exceeds 3 feet. The quality is generally that of a second-class household coal. The following general section is given for the workings in the Thankerton field:—

	Ft.	In.
Faky blaes	2	3
Ironstone rib	0	2
Faky blaes	0	4
COAL	0	3
BLACKBAND IRONSTONE	0	0½
COAL	0	8
Coaly blaes	0	1
COAL	0	3
Fireclay	0	4
COAL	1	6
Fireclay		

In the shaft of No. 12 Pit, Holytown, the bottom leaf has a similar thickness, while the underlying fireclay is used for brick-making.

The journal of a bore to the east of the village of Carfin gives the section as follows:—

	Ft.	In.
Fakes		
Blaes and fireclay	2	6
BLACKBAND IRONSTONE, with coal strains	1	0
Black blaes	0	10
COAL	0	2
Grey fakes	0	9
COAL	1	7
Faky fireclay	1	0

There is thus apparently some local recovery of thickness of the ironstone. The average section in the Parkhead workings is given as:—

	Ft.	In.
Rock		
Fakes	1	2
Blaes, with balls	1	7
Black blaes	0	3
COAL	1	0
Coaly blaes	0	5
COAL	0	3
Split	0	2
COAL	1	2

The blaes just above the Blackband Coal frequently contains "mussels," but these are not so crowded as to form a musselband.

Musselband Coal and Musselband Ironstone.—The Musselband Ironstone, which lies a certain distance above the Blackband Coal, has often been remarked in the journals of bores in this district, and is believed to be generally present, even where unrecorded. As in the type district to the north of Airdrie, the associated coal usually occurs a few feet below the ironstone, and where there is this relation there can be no doubt as regards the coal's identity.

The Unthank Farm bore, for instance, shows a 9-inch coal 5 feet below a 5-inch musselband ironstone. In the blind bore in No. 1 Pit, Milnwood, already alluded to, the coal has probably the same thickness, though a musselband ironstone is not here recorded. Farther east, the coal appears to attain a more nearly workable thickness. In a bore near No. 3 Pit, Thankerton, 21 inches of coal underlie the musselband at a distance of 16 feet. Near Kirklea, on the margin of the two quarter-sheets, the coal is 13 inches thick, though here also no musselband has been recorded.

On the northern margin of the district under consideration, a 17-inch coal in the bore in the old Garden Pit, Woodhall, is no doubt also on this horizon. A bore near Westfield shows a seam in the same position with the section:—

	Ft.	In.
Sandstone	1	3
Fakes and blaes	1	0
COAL	0	7
Soft ply	0	2½
COAL	0	3½
Soft ply	0	3
COAL	0	9
Fireclay	3	0

while another bore, slightly farther west, gives the seam a thickness of 19 inches in one leaf. None of the last three records shows any musselband, but a good natural section of the latter is seen on the south side of the Legbrannock Burn, about 300 yards south-west from Legbrannock farmhouse. Here we have:—

	Ft.	In.
Blaes and ironstone ribs	3	0
Parrotly musselband	0	2
Musselband (compact ferruginous limestone)	4 in. to	0 5
Blaes, with scattered "mussels"	0	6
Ironstone rib, with "mussels"	2 in. to	0 3
Parrotly blaes, with "mussels"	0 in. to	0 1
Pale grey blaes, with ironstone ribs	2	0

So far as the present district is concerned, there does not, from the preceding figures, appear to be any workable ironstone on this horizon.

Splint and Virgin Coals.—As these two seams are so close that they can sometimes be worked together, they will be treated as a single subject. The Splint Coal maintains a rather constant thickness, which on an average is about 4 feet. It has also its usual character of being largely a hard furnace coal, and its value for this purpose led to the early exploitation of the seam. It was being worked at six collieries in 1916, as against eight in 1914.

The Virgin Coal, being much the thinner of the two, was at one time somewhat neglected, but is now receiving greater attention. In this district it lies a foot or two below the Splint, and is frequently too thin to repay extraction. In 1916 it was being wrought at two collieries in the district, Hattonrigg and Thankerton. It is known also to have been wrought to a small extent at No. 4 Pit, Cleland, near the western extremity of the village of Newarthill.

At Hattonrigg there is often 7 to 10 feet of blaes between the Virgin and the overlying waste of the Splint Coal. The latter was worked more than thirty years ago, and in the interval the waste has become consolidated into a fairly compact mass, so that there is less difficulty than might have been anticipated in working the lower seam. A bore at No. 3 Pit, Thankerton, shows the Virgin Coal to be 20 inches thick, and only 5 feet below the Splint Coal pavement. In a bore in the old Garden Pit, near Woodhall, the former has the same thickness at a depth of 7 feet below the overlying seam.

A good surface exposure of the two seams is seen in an old quarry near Townhead. Here we have:—

	Fms.	Ft.	In.
Blaes, with irony bands	0	3	0
COAL	0	3	9
Fireclay	0	1	0
Blaes, with ironstone balls	0	2	0
COAL	0	1	0
Fakes and fireclay	1	4	0
Sandstone	6	4	0

In the Holytown field the Virgin is a foot in thickness, and is separated from the Splint by 10 to 14 inches of stone. The Unthank Farm bore shows more than one thin coal to occur below the upper seam. The section is:—

	Ft.	In.
SPLINT SEAM	3	9
Blaes	0	2
COAL	0	7
Fireclay	0	9
COAL	1	4
Fireclay	1	1
COAL	0	10
Blaes	0	1
COAL	0	4

In the Hattonrigg workings a section of the Splint Coal is:—

	Ft.	In.
Sandstone		
Fakes	0	2
COAL	3	4
Sandstone		

At Milnwood Colliery the Splint and Virgin form a single working, with the following thicknesses. (See Plate IV., Section 2).

	Ft.	In.
SPLINT SEAM	2	10
Fireclay	0	6
VIRGIN COAL	2	2
Fireclay	0	4
COAL	1	0
Wild gas coal	0	10

Eighteen inches below the base of this section there is a 6-inch gas coal.

In one or two localities the upper seam is only in part a splint coal. Thus in the North Motherwell field the section is given as:—

	Ft.	In.
SOFT COAL	0	6
HARD COAL	1	7
SOFT COAL	0	6
GAS COAL	0	7
SOFT COAL	0	1
Black blaes	0	1
SOFT COAL	0	9
Black blaes	0	1
SOFT COAL	0	9

and in the Carfin old workings:—

	Ft.	In.
FREE COAL	0	9
SPLINT COAL	1	11
GAS COAL	0	6
FREE COAL	1	0
Fireclay	0	3
VIRGIN COAL		

Reference has already been made to a curious rectilinear want which affects only the Splint seam at Douglas Park Colliery. This extends, with a similar south-easterly direction, into Lanark 12 S.W., having been proved in the Splint Coal in North Motherwell and Motherwell Collieries. Its width never exceeds 50 yards, for a distance of fully a mile. An inspection of a mine road running through it showed no evidence of local erosion, but distinct lines of movement, inclining towards one another, on opposite sides of the belt of removal. In some parts of the Motherwell field the sides are irregular, little promontories of Splint Coal running almost across the breadth. Where the Virtuewell has been mined beneath the want, it is unaffected by the movement referred to.

A musselband is sometimes found a short distance above the Splint Coal, as, for instance, at Hattonrigg. It is probably this bed which is seen at the south-eastern end of the Townhead Quarry, where we have:—

	Ft.	In.
Wild parrot	0	6
Irony musselband	0	7
Fireclay	2	0

Humph Coal.—This coal is usually thin, and of rather inferior quality, and has not, as a consequence, been as yet very extensively worked. Occasionally, however, it is overlain by a rather good fireclay, which adds somewhat to the value of the seam.¹

In 1916 it was being wrought in only two collieries in this district, namely, Woodhall and Parkhead, but it is known to have been previously wrought in others, including No. 3 Pit, Thankerton, Belhaven (Over Johnston), and Camp. The section in the Woodhall workings is given as:—

	Ft.	In.
Sandstone		
Fakes	3	0
COAL (wild)	0	5
Fireclay	0	5
COAL	1	9
Fireclay (hard)		

as compared to the following at Parkhead:—

	Ft.	In.
Blaes and balls		
COAL	1	8
Daugh	0	4
Hard fireclay		

These two localities are respectively on the northern and southern boundaries of the district. In the intervening area the thickness is not always so great, and in some bores just north of Motherwell the seam is not recorded. In No. 3 Pit, North Motherwell, however, the thickness is 18 inches, but the height above the Splint seam is only 13 feet (*see* Plate IV., Section 6).

A section of strata sunk through in No. 6 Pit, Carfin, gives 20 inches of coal about 4 fathoms above the Splint. In Milnwood No. 1 Pit, the Humph Coal is only a foot thick, while in a neighbouring bore to the south-west it measures 15 inches. In the Unthank Farm bore the section is as follows (*see* Plate IV., Section 1):—

	Ft.	In.
Fakes and sandstone		
Blaes and ironstone ribs	0	9
Dark blaes	0	5
Fireclay	0	9
COAL	1	5
Fakes		

About 10 feet above the coal is a 4-inch musselband, the representative of a band which is elsewhere very prevalent.

With exceptions such as the one which has been noted, the distance of the Humph Coal above the Splint usually varies from 4 to 5 fathoms in this district. The figure is of importance, as whatever areas of coal remain to be wrought probably overlies old workings in the lower seam.

¹ Dron : "The Coalfields of Scotland," 1902, p. 93.

An analysis of the coal from Belhaven Colliery, by Mr. D. M'Queen, gave the following results:—

Volatile combustible matter	.	.	.	41·93
Fixed carbon.	.	.	.	46·56
Ash	.	.	.	2·64
Moisture at 212° F.	.	.	.	8·87
				100·00
Sulphur	.	.	.	1·23
Phosphorus	.	.	.	·002
Coke	.	.	.	49·2
Specific gravity, 1·27; Calorific value, 7397 calories.				

Main and Pyotshaw Coals.—As in the area farther west, it is only rarely that these two combine, or approach so closely as to be recoverable in one working. They seem, however, to come together along the eastern margin of Lanark 12 N.W., as is seen when the two crops are followed south-eastwards from the vicinity of No. 4 Pit, Thankerton. This is in accordance with the fact that they are in the conjoint condition in the quarter-sheet to the east (Lanark 12 N.E.). The two coals appear to reach their maximum separation north of Motherwell, and in a bore close to the Mill Road are 8 fathoms apart. As would be expected, the intervening strata consist of sandstone and fakes, except for the fireclay underneath the Pyotshaw. The presence of a sandstone roof to the Pyotshaw is in fact a very general feature, and favourable to the working of the seam.

Near the western margin of the district, the two seams for a certain distance again coalesce. This occurs in the Orbiston and Bellshill workings, which lie partly within Lanark 12 N.W. and S.W. It has been recorded that in one instance the parting thickens from nothing to 40 feet in a distance of only 200 feet. Both seams often contain hard splinty layers, but this is especially a feature of the Pyotshaw, and has brought it into use for blast furnaces. The Main Coal is usually classed as a steam or second-class house coal.

In the year 1916 the Main Coal was being wrought in eight, and the Pyotshaw in twelve collieries in this district. No doubt in the former case the number would have been greater, but for the partial exhaustion of the seam.

In Milnwood No. 1 Pit the coals are separated by only two fathoms of strata. The thickness of the Main Coal is here given as 45 inches; of this 3 inches at the top consist of parrot. This gas coal is also found at North Motherwell Colliery, where the following section shows the alternations of character within the thickness of the seam:—

	Ft.	In.
Fakes roof		
GAS COAL	0	2
FREE COAL	0	7
SPLINT COAL	0	1
FREE COAL	2	1
SPLINT COAL	0	5
FREE COAL	0	6
Fireclay holing	0	1
Fakes		

The Pyotshaw section is here :—

	Ft.	In.
Sandstone	0	4
Blaes	2	6
FREE COAL	0	11
SPLINT COAL	2	2
FREE COAL	0	6
FOUL COAL	0	8
Fireclay	0	3
Sandstone		

At Parkneuk Colliery the Main Coal is 4 feet in thickness, but the Pyotshaw has become reduced to 2 ft. 4 in. In the Carfin Brickworks, which belong the United Collieries, Ltd., the stratum overlying the latter is made into brick without admixture, the product being fairly refractory.

The massive sandstone seen on the east bank of the South Calder, near Motherwell Corn Mill, and again about 200 yards to the north of Coursington Bridge, is believed to be that which often separates the Main and Pyotshaw Coals, the former of which is probably the coal exposed immediately beneath the sandstone, with a thickness of 2½ feet.

A further musselband horizon, equivalent to the "Cambuslang Marble," often occurs a little above the Pyotshaw. In the shaft of Milnwood No. 1 Pit, this is recorded about 4 fathoms above the coal. It is 6 inches thick, described as "irony," and rests on a 6-inch coal (*see* Plate IV., Section 2).

Ell Coal.—This seam is of more economic value in Lanark 12 S.W., than in Lanark 12 N.W. In the former it is usually fairly thick, and in one division. In the latter it is divided into leaves by partings which are sometimes of an inconvenient thickness. In a part of Lanark 12 N.W., there are in addition two thin coals, often close together, at a height of about 4 fathoms above the main part of the seam. These are sometimes regarded as forming part of the Ell Coal, and will be described under the present heading, though it is uncertain whether either, or both, really correspond to any part of the undivided seam.

The Ell Coal was being worked at 11 collieries in the district in the year 1916. There were also abandoned workings in other fields. In the southern quarter-sheet portions of the seam are ranked as a first-class coal, but an upper part, often called "heads," is inferior, and is often left as a roof to the workings, as the coal is overlain by a soft fireclay. The seam is particularly liable to spontaneous combustion, and parts of the workings have had for this reason to be walled up and abandoned, both at Carfin Colliery (of Messrs. W. Dixon, Ltd.) and at Parkhead.

In the North Motherwell field the Ell Coal is in excellent condition, the average section being :—

	Ft.	In.
Blaes		
Hard sandstone	1	8
BRASSY COAL	2	0
Faky blaes	0	4
FREE COAL	2	1
SPLINT COAL	0	7

	Ft.	In.
FREE COAL	1	2
Dark coaly fireclay	0	2½
FREE COAL	1	11
Fireclay	0	8
Sandstone		

In the shaft section of No. 3 Pit the total thickness is 7 feet. A fathom higher is a 2-foot foul gas coal. At Camp Colliery the coal measures 6 feet in one division, and, at Carfin No. 6 Pit, 10 feet with a parting of only half-an-inch. In the Holytown field the coal is in three not very widely separated leaves, as shown by the section in No. 12 Pit (*see* Plate IV., Section 5):—

	Ft.	In.
Fakes	0	0
COAL, foul	2	4
COAL, clean	2	2
Fakes	2	10
COAL, clean	1	6
Coal pugs	1	6
Fakes	2	0
COAL, clean	1	6
Daugh	0	2
Fakes		

All three leaves have been wrought, but the lowest is the best. The practice is to take out this layer first, then the uppermost, and finally the middle leaf. The “coal pugs” are not considered to be workable.

The seam is being worked at No. 3 Pit, Woodhall, where the section is:—

	Ft.	In.
COAL	3	1
Sandstone and fakes	3	3
COAL	1	7½

The lower leaf is a good house coal; the upper is used for manufacturing or steam. About 5 fathoms above the upper leaf occur the two thin coals already referred to (*see* Plate IV., Section 4):—

	Ft.	In.
COAL	0	8
Fireclay	1	2
Shale (brown)	3	0
COAL	1	7

The last item has been worked a little, but has not proved a paying subject.

At the time of the revision the Ell Coal had not been wrought either at Thankerton, Hattonrigg, or Milnwood, and it is of somewhat inferior value in this area. In the Thankerton field it is in three leaves, and the following may be taken as a representative section:—

	Ft.	In.
Grey fakes	2	0
Black blaes	0	6
COAL	1	9
Black blaes	0	3
COAL	0	8
Black blaes	0	3
Fakes	0	7
COAL	1	7
Black blaes	0	1
Grey fakes and sandstone ribs	1	4

The following table shows the relations and thicknesses of the two leaves of the undoubted Ell Coal, and of what is probably the lower of the two upper seams recorded at Woodhall, in the Unthank Farm bore, and No. 1 Pit, Milnwood, respectively :—

	Unthank.			Milnwood.		
	Fms.	Ft.	In.	Fms.	Ft.	In.
COAL	0	1	4	0	1	6
Strata	3	5	0	3	1	6
COAL	0	1	3	0	1	6
Strata	1	1	0	0	4	4
COAL	0	1	11	0	1	8

The three thin seams were also found, with partings of about the same thickness, in a bore on the site of No. 4 Pit, Hattonrigg Colliery.

A coal seen high up in the cliff, on the west side of the South Calder Water, about a quarter of a mile north-west of Coursington Bridge, has the following section :—

	Ft.	In.
Blaes		
COAL	0	8
Coaly blaes	1	0
COAL	2	0
Blaes and sandstone		

About 100 yards north-west of the bridge, on the same side of the river, a coal measuring at least 3 feet overlies, at a distance of about a fathom, an inferior blackband ironstone about two feet in thickness. Both the coals just referred to must be in or near the Ell position.

Upper Coal (of Glasgow), Palacecraig Blackband Ironstone, and certain higher seams.—It is unlikely that a seam formerly worked by a day-level in the wood a quarter of a mile south-east of Highsethead, and referred to as the "Upper Ell," corresponds to the Upper Coal. This seam is stated, by Mr. Miller of Legbrannock Colliery, to be the Ell Coal proper. If this supposition is correct, there appears to be no representative in the present area of the "Upper Ell" of Greenside Pit (Newhouse Colliery), which is not far to the east (*see* p. 81). The coal referred to lies 12 fms. above the Ell.

With this doubtful exception, the Upper Coal is not known for certain to be of economic value in any part of the ground under description, and the same applies to the Palacecraig Blackband Ironstone, except at one point on the northern margin. The ironstone was worked near Orchard Farm, but no section of the workings is now available. In the shaft of the Crow Pit, Woodhall, about half a mile west-south-west of Woodhall House, the Upper Coal is 14 inches thick, about 16 fathoms above the lowest leaf of the Ell. (*See* Plate IV., Section 4.) Five fathoms higher the Palacecraig seam is represented as follows :—

	Ft.	In.
Shale and ironstone ribs	2	0
COAL	1	1

Two coals and an ironstone are exposed in a stream running into the Shirrel Burn, a little below the bridge at Shirrel, 1 mile N.N.E. of Bellshill. The horizon is not far from that of the seams just

referred to, but cannot be determined more definitely. The section is as follows:—

	Ft.	In.
Blaes with sandstone ribs		
Parrotty blaes and ironstone with occasional mussels	2	0
COAL (at least)	1	6
Daugh	0	5
Fireclay	1	0
Sandstone	3	0
Blaes	5	0
BLACKBAND IRONSTONE, with some mussels	0	10
Blaes	0	8
COAL (at least)	0	6

A further exposure of blackband ironstone, about a foot in thickness, and also containing mussels, may be seen on the south bank of the Shirrel Burn, about 500 yards north of Unthank Farm.

In the bore at No. 3 Pit, North Motherwell, the following section occurs about 17 fathoms above the base of the Ell Coal.

	Ft.	In.
Blaes and balls	5	0
COAL	2	3
Fireclay	1	6
Fakes	1	2

This is called the Upper Coal, and the position is about correct.

A fairly good coal, not less than 14 inches in thickness, is said to have been exposed at one time within the boundaries of Dalzell Iron and Steel Works. This may have been either the Upper Coal or some higher seam. In a railway cutting 200 yards south-east of Pit No. 3, Dalzell Colliery (marked No. 2 on the Ordnance Survey Map), a 6-inch blackband ironstone containing "mussels" occurs at a height of perhaps 20 fathoms above the Ell Coal.

It may also possibly be the Upper Coal which occurs, with a thickness of at least a foot, on the right bank of the South Calder Water, about 300 yards west of Carfin House. What is possibly the same coal appears again on the same bank of the river about 200 yards farther west, and seems to have been wrought a little in this locality.

In the strata intervening between the Palacecraig Blackband Ironstone position and Skipsey's Marine Band, various bores and shaft sections record the presence of thin coals, but, as in the case of the last two seams considered, it is impossible to trace them from section to section. Thus, at Hattonrigg No. 4 Pit, a thin coal occurs about 28 fathoms above the lowest member of the Ell Coal. The same coal is probably present in Milnwood No. 1 Pit, with a thickness of 14 inches, but in a diamond bore 300 yards to the south-west seems to have dwindled to 8 inches. In the latter a 1 ft. 9 in. coal occurs 41 fathoms above the Ell, but this cannot be more than 10 inches thick in the shaft section, though it appears again to attain a thickness of 1 ft. 6 in. in the Unthank Farm bore.

We need only refer to a coal 1 ft. 4 in. thick, 28 fathoms above the Ell, in the shaft of No. 12 Pit, Holytown. The distance below surface is about 10 fathoms, and in a burn section close to the shaft

there is a wild parrot coal, 18 inches thick, and including a layer of "mussels" near the base of the seam.

It may be stated that an ironstone containing *Lingula* was detected by Mr. Tait, during the Survey revision, in the Shirrel Burn, about 500 feet north-east of Shirrel Farm. This bed is mentioned, not on account of any possible economic importance, but because the fossil indicates an approach to marine conditions, and actual marine beds are very rare in Scottish Coal Measures. The position is believed to be not very far below Skipsey's Marine Band, which is a marine horizon of a more decided type.

Skipsey's Marine Band.—Although occasional thin coals, which may even exceed a foot in thickness, do occur above this horizon, the fact that it overlies by a certain distance all the seams of coal and ironstone which are workable under present conditions, gives this band a certain value as an index-bed, in various parts of Scotland.

Skipsey's Marine Band is a hard, dark grey limestone, with abundant marine fossils¹, but so thin that it has not been recorded in any of the bores or shafts of this district. It is, however, exposed in several natural sections, and should be searched for with its distinctive fossils, in any future boring operations that start from above its horizon.²

Three of the exposures occur on the banks of the South Calder Water, near Jerviston Camp Bridge. The best of these is on the west of the river, 150 yards to the south of the bridge, the other two are on the same side of the river, between 200 and 250 yards farther north. In the southernmost exposure the band measures a foot or eighteen inches in thickness, and overlies a thin coal.

The limestone is also well seen on the east side of the Lesmahagow Branch Railway, about half a mile south of Motherwell Station. Here it is folded into a gentle syncline, on the south side of which the section runs somewhat as follows:—

	Fms.	Ft.	In.
Blaes, with ironstone courses, and irregular bands of sandstone .	3	4	0
Fakes, ... 2 ft. to	0	3	0
Blaes, with ironstone courses .	1	2	0
SKIPSEY'S MARINE BAND .	0	1	0
Daugh	0	0	2
COAL	0	0	9
Fireclay	1	0	0
Calcareous sandstone and softer beds	0	4	0
Massive sandstone	1	1	0
Soft rubbly sandstone, and clayey blaes	0	5	0
Sandstone	1	0	0
Blaes	0	1	0
COAL	0	1	1

From the Marine Band at this locality the following species have been collected by Mr. Tait:—

Crinoid joints.
Ambocoelia urei (Flem.).
Chonetes laguessiana de Kon.

¹ See "Econ. Geol. Central Coalfield, Area V." (*Mem. Geol. Surv.*), 1916, Plate XII.

² See "Econ. Geol. Central Coalfield, Area V." (*Mem. Geol. Surv.*), 1916, Chapter X.

Lingula mytiloides *J. Sow.*
 Productus anthrax *Hind.*
 Productus sp. [nov?].
 Spirifer.
 Posidoniella.
 Posidonomya becheri *Bronn.*
 Pterinopecten papyraceus (*J. de C. Sow.*).
 Glyphioceras.
 Orthoceras.
 ? Pleuromutilus costatus *Hind.*

The limestone is seen again on the banks of the Clyde, a short distance south of the district now being considered (*see* p. 120), and is there 53 fathoms above the base of the Ell Coal. In the South Calder the distance is 56 fathoms, while just beyond the northern margin of the district it probably amounts to 74 fathoms. There is thus evidence that the intervening strata progressively increase in thickness from south to north.

Barren Measures.—As stated in the introductory chapter, Skipsey's Marine Band is taken as forming the division between the Productive and the overlying Red or Barren Coal Measures. This is, however, merely a convention, and the change is not a sharp one, either in the productive character or in the coloration of the beds. Thus, as already mentioned, there are thin coals quite commonly above the Marine Band, while none of the beds described in the section as underlying or overlying the limestone in the Motherwell railway cutting is either red or mottled in colour, nor distinguishable in type from beds associated with the well-known coals which lie below. In the Unthank Farm bore, on the other hand, red beds are found about 20 fathoms below the point where we should have expected the limestone to occur.

The shaft of No. 3 Pit, North Motherwell, must pierce about 65 fathoms of Barren Measures, but the Marine Band has not been identified. Thick beds in the highest portion of the section, described in the journal as "calmy fireclay," are probably some of the mottled marls so frequent in this position. The thickest coal occurs about 15 fathoms below rock-head, but is only 13 inches in thickness (*see* Plate IV., Section 6).

The South Calder valley, west and north-west of the pit, shows good natural sections of the same sequence. At and near the Corby Craig the following succession is observable:—

	Fms.	Ft.	In.
Yellow sandstone	6	1	6
Ferruginous sandstone with coal streaks	0	2	6
Sandstone	1	4	0
Gap	2	3	0
Flaggy sandstone	1	4	0
Grey-green clay shale, with plant remains	0	4	0
COAL	0	1	0
Grey, green, and dark fireclay	2	3	0
Greenish-yellow sandstone	1	2	0
Grey-green clay shale	0	5	0
Dark-grey blaes, with plant remains	0	2	6
COAL	0	0	10
Pale grey clay shale	0	3	0
Flaggy sandstone and blaes	2	0	0

finitely traced between this locality and Legbrannock Farm, but it must pass between an old shaft and a bore-hole, the former of which is 300 yards and the latter 600 yards to the south-west of Highsethead. The throw is here about 50 fathoms, but it amounts to about 80 fathoms in the Legbrannock Burn, in several separate lines of movement.

Braidhurst Fault.—This is another important dislocation, with much the same general direction as the Tunnel Fault, but with a downthrow to the south-west. It was proved in the workings from Braidhurst Colliery, a little to the east of the South Calder Water, and has here an estimated throw of 100 fathoms. It was also pierced by an old water-level, which debouches on the South Calder a little above Milnwood House. From this point the course is not quite clear, but a probable continuation occurs in the Hattonrigg workings, about 500 yards north-east from the pit-bottom. In one part of the workings the fault is accompanied by a thin vein of white trap; this is uncrushed, and thus almost certainly later than the movement. The throw has here diminished to about 33 fathoms, and the fault has not been traced beyond the edge of the quarter-sheet.

New Stevenston Fault.—This name is suggested for a fault with northerly downthrow, which can be followed from the neighbourhood of Milnwood Junction to beyond the eastern margin of the district, with a direction which alters gradually, from considerably south, to somewhat north, of east. Between Milnwood No. 4 Pit (situated close to Milnwood Junction), and the Biggins Farmyard bore, it causes an alteration of level of at least 80 fathoms. In underground workings west of New Stevenston House, the Main Coal is thrown almost to the level of the Virtuewell, which indicates a throw of nearly 40 fathoms.

North Motherwell Fault.—This name may conveniently be applied to the fault with a large downthrow to the north which intersects the North Motherwell field. It is formed by the confluence of the Bothwell and Whistleberry Faults, which have been described as separate fractures, in dealing with the district of Uddingston and Bothwell (p. 44). The resultant fault is well seen in a cross-cut, about 200 yards north-west of North Motherwell No. 2 Pit, where it has a displacement of about 92 fathoms, with an inclination from the horizontal which does not seem to exceed 35° . The throw at this point is probably a maximum; the fault can be followed along the northern boundary of the Parkneuk workings, but does not seem to cross the South Calder.

A rather interesting belt of disturbance runs across the Motherwell field, passing about 200 yards west of No. 4 Pit. The belt is about 100 yards in width, and the net result is to move the coal seams about 27 fathoms down to south-west. Although faulting is present, the structure seems to be in the main that known to geologists as a monoclinical fold. The strata on both sides have a gentle dip, but within the zone of disturbance they are tilted to the south-west at angles as high as 35° .

A north-westerly fault with reversed throw occurs at Holytown Colliery. The downthrow is about 60 feet to the south-west, while the inclination of the fault is in the opposite direction, though not

far from vertical. As the dip in the neighbourhood is to the south and west, it is not unlikely that the reversal of hade is due to subsequent tilting.

Whinstone Dyke.—Only one whinstone "gaw," or dyke, has been proved within the district. This has a thickness of from 5 to 7 feet, and runs in a north-westerly direction through the workings from Hattonrigg Colliery. The material is somewhat different from basalt, being of the variety known to petrologists as camptonite. The dyke is almost in line with one having a similar direction at Rosehall Colliery, and it is likely that the two will prove to be continuous.

"Sand Dykes" or Buried River Channels.—The district contains one or two instances of "wants" in coal-seams, where they are near the surface, which are due to wash-outs along old buried river courses. The resulting channels have been filled with sand and gravel, and then sometimes covered over with boulder clay in such a way as to be now imperceptible at the surface. The erosion took place most probably during the glacial period, and was long subsequent to the deposition of the coal seams.

A channel of the type referred to occurs at Dalzell or Coursington Colliery, and has been described by R. W. Dron.¹ It has cut down through the Ell and Main Coal seams, and can be traced for a mile in the north-west direction into the Parkneuk field. The bottom of the channel is about 90 feet above sea-level, though the surface of the ground is over 200 feet. In the Old Series Survey map (Lanark 12), this channel was drawn eastwards past Nether Johnston, and thence across the South Calder Water, near Cleland. A thickness of 24 fathoms of sand and gravel certainly does occur at Nether Johnston (*see* p. 130), but in default of further evidence this part of the channel will not be shown on the New Series map.

A similar "sand dyke" has been proved, in the Pyotshaw Coal level, at Carfin Colliery, and has removed the seam for a breadth of 40 yards.

C. T. C.

B. DISTRICT OF CLELAND AND NEWARTHILL.²

(Comprising the larger part of Lanark, 12 N.E. and 12 S.E.)

This district extends from Newhouse by Newarthill and Cleland as far as the town of Newmains. It is limited on the north-east by the area of Millstone Grit before referred to (Chapter II., p. 11), and on the other sides by the boundaries of the quarter-sheets. Within this area are representatives of Coal Measure strata, extending from

¹ "Notes on Buried River Channel at Motherwell," *Trans. Geol. Soc. Glasgow*, vol. xv., 1914, p. 1.

² For information used in this section we have especially to thank the following:—Auchinlea Coal Co., Ltd., and Mr. Stevenson; Coltness Iron Co., Ltd.; Messrs. T. Gibb & Sons, Ltd.; Greenhill Colliery Co., Ltd., and Mr. Forsyth; Horn (Glasgow), Ltd., Mr. T. Hill and Mr. Howieson; Messrs. T. King & Co.; Lynn Coal Co., Ltd., and Mr. Dyer; Mr. Marshall of Sandyford; Mr. John Miller of Legbrannock Collieries; Murdostoun Colliery Co., Ltd., Mr. Colquhoun and Mr. Mackie; Col. R. K. Stewart of Murdostoun; Messrs. Stewarts and Lloyds; United Collieries, Ltd., Mr. D. McQueen and Mr. J. Lowden.

the base to some distance above the seam locally known as the Upper Ell, and including at least fourteen workable seams. The following is an average section :—

GENERAL SECTION OF COAL MEASURES OF DISTRICT OF CLELAND AND NEWARTHILL.

	Thickness.			Depth.		
	Fms.	Ft.	In.	Fms.	Ft.	In.
UPPER ELL COAL.				0	0	0
Strata						
ELL COAL	0	5	0	12	0	0
Strata						
PYOTSHAW and MAIN COAL	0	6	0	22	0	0
Strata						
HUMPH COAL	0	1	6	30	0	0
Strata						
SPLINT COAL	0	4	0	33	0	0
Strata						
VIRGIN COAL	0	1	0	33	3	0
Strata						
MUSSELBAND IRONSTONE				40	0	0
Strata						
COAL	0	0	9	41	0	0
Strata						
AIRDRIE BLACKBAND IRONSTONE	0	1	0	50	0	0
Strata						
AUCHINLEA SANDSTONE	6	0	0	57	0	0
Strata						
ROUGHBAND IRONSTONE	0	0	6	59	0	0
Strata						
VIRTUEWELL COAL	0	2	0	60	0	0
Strata						
BELLSIDE IRONSTONE	0	0	6	64	0	0
Strata						
COAL	0	1	0	66	0	0
Strata						
KILTONGUE MUSSELBAND, SHALE, and IRONSTONE				72	0	0
Strata						
KILTONGUE COAL	0	1	6	78	0	0
Strata						
UPPER DRUMGRAY COAL	0	2	0	85	0	0
Strata						
MID DRUMGRAY COAL 8 in. to	0	3	0	90	0	0
Strata						
LOWER DRUMGRAY COAL	0	2	0	96	0	0
Strata						
SHOTTS GAS COAL	0	1	0	100	0	0
Strata						
CLEFTED or BALMORAL COAL	0	1	6	109	0	0
Strata						
CROFTHEAD COAL	0	1	0	132	0	0
Strata						
Position of CROFTHEAD SLATYBAND IRONSTONE=Base of Coal Measures				136	0	0

The Upper Slatyband Ironstone of Earlshill, which corresponds roughly in position with the Crofthead Slatyband, is not known to extend into this area.

A Slatyband associated with a band of "mussels" (*Carbonicola*) was wrought from daylight on the banks of the Tillan Burn about

a quarter-mile north of Birniehill. The position of this seam is problematical, but the fresh water fossil shows that it is probably above the base of the Coal Measures. The Goodockhill Ironstone is marine, as we have seen (p. 12).

Crofthead Coal.—A coal varying from 1 ft. 7 in. to 2 ft. 6 in. was found in several bores near Easthill, about a mile to the east of Bellside. Nothing is known as to its quality. This coal has been shown on the map as the Crofthead, but although there is some evidence in favour of this view it may possibly be as low in the sequence as the Bowhousebog (*see* p. 13). In a bore beside the Hill Glen the Crofthead almost undoubtedly has a thickness of 1 ft. 8 in., but in another, about a quarter mile west of Murdostoun Saw Mill, it has shrunk to only 9 inches of coal overlain by $3\frac{1}{2}$ inches of ironstone. In two bores near Goodockhill what may be the Crofthead Coal is respectively 11 inches and 15 inches in thickness, in each case including a parrot top. In other bores in this district the recognition of the Crofthead Coal is in the main a matter of conjecture, but enough is known to show that except possibly near Easthill and Hill Glen it is not a payable subject.

Clefted or Balmoral Coal.—This coal, which is the equivalent of the Mill Coal of Armadale, is thin but fairly constant over at least a part of the two quarter-sheets. In the bore beside Hill Glen already referred to it is given as being 1 ft. 9 in. in thickness, but in the bore west of Murdostoun Saw Mill it is only $8\frac{1}{2}$ inches. A bore near Old Sandyford (on the northern margin of 12 N.E.) proved this coal to be 1 ft. 8 in., while another near Newhouse gave the following section. (*See* Plate III., Section 7):—

	Ft.	In.
Dark blaes		
COAL	1	3
Fireclay	2	0
COAL	0	8
Fireclay	1	5
Sandstone		

A thin underlying seam is a constant feature near Armadale. It is present also in the Hill Glen Bore, and very likely forms the lower part of the Clefted Coal where the latter is wrought under that name.

Shotts Gas Coal.—This coal is also a constant feature, and was worked to a small extent at Lauchope No. 2 Pit. Here the section was :—

	Ft.	In.
Faky blaes	3	0
Soft blaes	1	2
GAS COAL	0	5
ROUGH COAL	1	1
Blaes and balls		

There were occasionally mussels in the roof. In the Newhouse bore it measures a foot, without any gas coal, but at Knownblehill Colliery¹ near Omoa it consists of 6 inches of "wild gassy coal" over

¹ The pits of this colliery are just north of the main railway line, 600 yards west from Omoa Station

3 inches of "rough gas coal." At Hill Glen the thickness given is 1 ft. 6 in., again without any record of gas coal.

Lower Drumgray Coal.—In the Bailliesmuir pit workings, just north of Newmains, this seam has a thickness of from 20 to 24 inches. This is also about the thickness in the pits of the Murdostoun Colliery Company, situated between Newmains and Cleland. Farther north the coal is wrought in the Howmuir, Greenhill, and Lynn Collieries,¹ and it maintains an average thickness of rather over 2 feet. The seam is overlain by about a foot of poor fireclay. As in other districts it has the general character of a household coal.

Information as to areas where this coal and others described may be looked for in the unwrought condition will be found in a subsequent paragraph. The relative constancy of this seam gives it an importance out of proportion to its thickness. The following is an analysis by Mr. D. M'Queen of the coal, which had a thickness of 22 inches, at the old No. 43 Pit, Townhead, a short distance to the west of Westerhouse:—

Volatile matter	.	.	.	.	32·99
Fixed carbon	.	.	.	.	58·47
Ash	.	.	.	.	1·63
Moisture at 212° F.	.	.	.	.	6·91
					100·00
Sulphur	.	.	.	.	·578
Phosphorus	.	.	.	.	·001
Coke	.	.	.	.	60·10
Calorific value, 8231 calories.					

Mid Drumgray Coal.—This coal attains its maximum at Bailliesmuir pit, where the section is:—

		Ft.	In.
Rock			
Dark Fakes		0	4
COAL	. . . 1 ft. 11 in. to	2	2
Stone	. . . 5 in. to	0	8
COAL	. . . 4 in. to	0	8
Fireclay			

South-eastwards from the pit bottom the stone is thin; northwards it thickens. A section of the seam is exposed on the right bank of the South Calder Water, south-west of Murdostoun House, where we have—

		Ft.	In.
Fakes			
COAL		2	3
Mainly fireclay		4	6
COAL		0	5
Fireclay			

The seam is at present wrought from Murdostoun Colliery, where an average section is 18 inches of free coal of good quality for gas making. The pavement consists of hard fireclay, and 9 feet below is

¹ Howmuir Colliery is just north of Omoa Railway Station; Lynn Colliery (now abandoned, 1919) is on the highroad, half-way between Newhouse and Salsburgh.

a six- or twelve-inch coal which probably corresponds to the lower division of the seam at Bailliesmuir.

The strata forming the roof of the coal at Murdostoun are very variable. They are pierced for a distance of a few feet by occasional nearly vertical fossil tree stems about a foot in diameter, in which the cortical layer has been partly converted into coal, while the interior is filled by a sandy non-bituminous shale with traces of horizontal bedding. These usually stop short of the coal itself, but in one case a stem was found to continue through most of the thickness of the coal with a filling of the nature mentioned. The fact is well authenticated, and is put on record because of its bearing on the rival theories of the origin of coal seams.

The seam deteriorates to the west, as is shown by a bore at No. 3 Pit, Cleland (*see* Plate III., Section 8). It is also poorer to the north, being almost absent in a bore which proved the position near Birniehill. It may, however, have been the Mid Drumgray Coal which was sunk or bored through, with a thickness of 23½ inches in an old pit 500 yards to the south of Goodockhill, and the seam is certainly present at Lynn Colliery, where it consists of 13 or 14 inches of household coal, with a roof and pavement of fakes.

Upper Drumgray Coal.—This coal, while a more constant feature than the Mid Drumgray, is less regular in thickness than the Lower Drumgray seam. At Bailliesmuir it measures 18 or 20 inches, and was not being wrought at the time of the Survey revision. At Murdostoun Colliery it is still thinner. At Howmuir Pit (just north of Omoa Station) it has increased to 31 inches, but at Knownblehill Colliery, not far to the west, it has again dwindled to 17, and at Townhead No. 43 Pit, near Chapelknowe, to only 14 inches in thickness. In the northern of the two quarter-sheets (Lanark, 12 N.E.), the coal maintains a fairly even section of a little over two feet. It has everywhere a one- or two-foot blaes roof, and a certain amount of fireclay as pavement. As in other districts it is a hard splint or furnace coal. The following is an analysis by Mr. D. McQueen of the seam from No. 43 Pit, Townhead:—

Volatile combustible matter	.	.	33·87
Fixed carbon	.	.	54·56
Ash	.	.	4·52
Moisture at 212° F.	.	.	7·05
			100·00
Sulphur	.	.	·428
Phosphorus	.	.	·003
Coke	.	.	59·08
Calorific value, 7211 calories.			

The band of "mussels" occurring a few feet above this coal seems not to be so constant in this area as in other parts of the joint Lanarkshire and Stirlingshire coal-field. It is sometimes unrecorded in bore journals, but is well seen about a fathom above the coal where the latter outcrops in the Tillan Burn.

Kiltongue Coal.—This coal is also very inconstant. At Bailliesmuir it measures 18 inches, and has not yet been worked. At Murdostoun Collieries the approximate section is:—

	Ft.	In.
Rock		
Blaes	2	6
FREE COAL	1	9
HARD COAL	0	3
FREE COAL	0	6
Fireclay	0	2
Rock		

It has been pretty largely wrought in this district, and also near Bellside. At Knownoblehill Colliery the seam comprises 14 inches of clean overlying 4 inches of slaty coal. At Greenhill Colliery (Auchinlea Pit) the section is:—

	Ft.	In.
Blaes and fakes, more than	3	0
COAL	1	7
Slit	0	1
COAL (wild)	0	7
Fireclay		

Northwards the coal appears to thin, and there seems to be no record that it has been wrought in Lanark 12 N.E., except near the locality just mentioned.

An analysis of this seam from Townhead No. 43 Pit, by Mr. D. M'Queen, gave the following results:—

Volatile combustible matter	30·03
Fixed carbon	55·08
Ash	6·03
Moisture at 212° F.	8·86
	100·00
Sulphur	1·032
Phosphorus	·002
Coke	61·11
Sp. Gr., 1·26; Calorific value, 6695 calories.	

The *Kiltongue Musselband Shale and Ironstone* is in this district, as elsewhere, fairly persistent, though not in the main a workable subject. At Knownoblehill Colliery the section is:—

	In.
Shaly blaes	
GOOD SHALE	5
INFERIOR SHALE.	4
Very poor musselband IRONSTONE	3
FREE COAL	4

At No. 1 Pit, Biggarford Colliery:—

	In.
SHALE	5
INFERIOR SHALE.	9
IRONSTONE	4

The Musselband is well exposed in the Tillan Burn, where four feet of shale or shaly blaes, with courses of musselband ironstone at base, overlie 8 inches of clear coal. The Ironstone was wrought to a small extent in some pits a little to the north.

Ladygrange Coal.—Certain bores in the two quarter-sheets show a coal nine inches or a foot in thickness at a distance of about

2 fathoms below the Bellside Ironstone. At No. 1 Pit, Biggarford Colliery, it measured 1 ft. 2 in., and was correlated with the Ladygrange.

Bellside Ironstone.—This seam, which derives its name from the village of Bellside, has a limited distribution. It has been wrought over an area extending from Bellside about two miles to the north, but the workings have long been discontinued, and not much can now be learned as regards the Ironstone. It was a blackband, and is stated by Grossart to have been 6 inches in thickness, and of excellent quality.¹ The most recent workings in the seam appear to have been at the Langbyres, now known as the Howmuir Pit, north of Omoa Station. Here the section was:—

	Ft.	In.
Fakes	4	0
Blaes	2	0
BLACKBAND	0	5
COAL	0	2

The seam thins towards the west, being only 2½ inches thick at Knownblehill, and apparently it does not extend into the adjoining quarter-sheets in this direction. Southwards it is more persistent, having been wrought, as we shall see (p. 110), near Wishaw.

Virtuewell Coal.—This seam was at one time known in the district as the Wee Coal of Cleland. At No. 9 Pit, Greenhill Colliery, the section is:—

	Ft.	In.
Rock		
Fakes	1	10
GAS COAL, 2 in. to	0	5
COAL	2	0
Fakes		

The following section is recorded at one of the Spindleside Pits, near Cleland:—

	Ft.	In.
Rock		
Fakes	0	11
Blaes	1	3
Shale with balls	0	2½
Gas shale	0	3½
"Blankets"	0	6
COAL	2	2
Daugh	0	2

At Foulisykes, No. 1 Pit, a layer of splint coal was included as follows:—

	Ft.	In.
Sandstone		
Faky fireclay	1	9
Iron balls	0	2
Black blaes	0	1
PARROT	0	6
FREE COAL	0	7
SPLINT COAL	0	9½
FREE COAL	0	8
Fireclay	0	2
Hard fakes		

¹ "On the Upper Coal Measures of Lanarkshire," *Trans. Geol. Soc. Glasgow*, vol. iii., 1871, p. 96.

It will thus be seen that the coal does not vary much in thickness throughout the district; it is partly used as a steam and partly as a household coal. It has always an oil-shale, or parrot coal, on top, though this has not, so far as is known, been used for distillation in this district.

Roughband Ironstone.—Although this seam can be identified in other districts, the name "Roughband Ironstone" is most usually associated with the area under description. At Knownoblehill Colliery the ironstone was worked as a separate seam, with the section :—

	Ft.	In.
Hard rock	0	6
Fireclay	1	6
ROUGHBAND IRONSTONE	0	6
Blaes	1	0
CLAYBAND IRONSTONE (foul)	0	5
Blaes and fakes		

The Roughband itself came from 5 to 7 feet above the top of the Virtuewell Coal. It consists of clay ironstone in nodules, but differs from an ordinary clayband, being lighter in colour, speckled in appearance, and containing a larger quantity of carbonate of lime.

The ironstone was also worked from No. 3 Pit, Cleland, where it was 8 inches in thickness, and although 9 feet above the top of the coal seam, appears to have been extracted along with the latter. No. 1 bore at No. 2 Pit, Cleland (on the opposite side of Cleland House), gave the following section :—

	Ft.	In.
Sandy ironstone	0	8
Soft dark blaes	0	9
Fakes and blaes	1	2
ROUGHBAND IRONSTONE	0	7

the last item one fathom above the Virtuewell. A bore 650 feet west from Foulisykes, No. 1 Pit, shows 5 inches of ironstone two fathoms above the coal. An ironstone, 6 inches thick, and full of crushed lamellibranch fossils, which is seen in the South Calder gorge, a little below Murdostoun Mill, is more probably below the coal, and may be near the Bellside horizon.

The *Auchinlea Sandstone* comes between this seam and the next in order. It is perhaps 10 fathoms in thickness near Auchinlea and Bellside, and is shown in bores to be present, though usually thinner, in other parts of the area (*see* p. 124).

Airdrie Blackband Ironstone and Blackband Coal.—An ironstone, believed to be the Airdrie Blackband, was wrought somewhat extensively to the north and north-east of Newarthill. Little has been ascertained as to these workings, but a bore section reads :—

	Ft.	In.
Dark slaty COAL	0	6
BLACKBAND IRONSTONE	1	3
COAL and shale	2	3

The locality of the bore is simply given as Newarthill. A record, which perhaps applies to the old workings near Greenside, gives a

thickness of from 6 to 11 inches of blackband, 11 fathoms above the Virtuewell. There can be little doubt, from the nature of its section, and from its position in the sequence, that this is really the Airdrie seam.

A difficulty arises from the fact that a coal was worked in the Greenside neighbourhood directly beneath the ironstone, at a distance of about 14 feet. This seam is stated to have varied from 15 to 42 inches in thickness, and was named the Blackband Coal. No such degree of separation between the coal and ironstone is elsewhere known. Where the position includes both minerals, they are in contact, as in the bore section already quoted. The difficulty appears to be most adequately met by supposing that the Greenside "Blackband Coal" is an additional seam. The latter appears to be represented, about 6 fathoms above the Virtuewell, in a section of No. 1 Pit, Biggarford Colliery, where it is 1 ft. 5 in. in thickness, and underlies, by about 4 fathoms, a nine-inch coal which may replace the Ironstone.

The Greenside Coal can perhaps also be identified in Lanark, 12 S.E. An old bore at Glencleland, whose position is not accurately known, shows 1 ft. 9½ in. of coal, at a height of 6 fathoms above the Virtuewell, and immediately underlying the Auchinlea Sandstone. There is, however, no trace of the horizon in the bore at No. 2 Pit, Cleland, which cannot be very far away.

The undoubted Blackband Coal, on the exact horizon of the Ironstone, is well represented in the southern quarter-sheet. It attained a workable development in some old pits between Cleland Townhead, and the main Caledonian line.

Here the section was :—

	Ft.	In.
Blaes roof		
COAL	1	3
Blaes	0	3
COAL 3 in. to	0	4
Blaes	0	4
COAL 1 ft. 2 in. to	1	4

It was classed as a steam coal, of fairly good quality for locomotives. It was also worked from No. 3 Pit, Cleland Colliery.

In the bore from No. 2 Pit the section is :—

	Ft.	In.
Grey fakes		
Dark blaes	1	0
COAL	0	3
Dark blaes	2	0
SOFT COAL	1	8
Fireclay and blaes	0	7
Light grey fakes	1	6

Eastwards the coal appears to thin, though, it is always recognisable. It measures 1 ft. 5 in. in the Howmuir Pit, and is seen a short distance above the Auchinlea Sandstone, in the quarry close to Bellside House. It is only 10 inches in thickness in the bore already referred to near No. 1 Pit, Foulisykes.

Musselband Coal.—In the Howmuir Pit the following section was recorded while sinking the shaft :—

	Ft.	In.
MUSSEL IRONSTONE	0	10
Calmy blaes and balls	4	10
Fireclay	0	5
Balls	0	3
White blaes	0	6
COAL	1	0
Coaly slate	0	11
Sandstone		

The coal is referred to as a hard splint coal, giving a white and abundant ash when burnt. In No. 1 bore, at No. 2 Pit, Cleland, the ironstone was $4\frac{1}{2}$ inches, and the coal in two divisions 9 inches and 4 inches, separated by 1 ft. 8 in. of dark blaes. The two seams are apparently not persistent, and have not, so far as is known, been recorded together in any other bore or sinking.

Virgin Coal.—Near Ravenscraig the Virgin Coal measured 10 inches, and was separated by 1 or 2 feet of stone from the base of the Splint. At No. 2 Pit, Cleland, the coal measured a foot, and at No. 1 Pit, Biggarford Colliery, 1 ft. 3 in., coming at least 2 feet below the overlying coal. Though no further data are available it is probable that this coal is universally present beneath the next in order.

Splint Coal.—This coal is not now being wrought, but formerly it ranked with the Ell and the Main as one of the most important seams. At Newmains it measured 4 ft. 4 in., overlain by blaes and balls, and underlain by fireclay. It was somewhat thinner on the western margin of the area under discussion, at Meadowhead, Ravenscraig, and Glencleland Collieries. Although it was largely wrought, no record of its thickness in the northern quarter-sheet (Lanark 12 N.E.) is available to the writer. It is known, however, to have been partly burnt by a sill which is intruded into the strata somewhere between the Splint and the Main Coal.

Humph Coal.—At the time of the revision this seam was being wrought from Nos. 1 and 2 Pits, Glencleland Colliery. The section was :—

	Ft.	In.
Fakes		
Soft blacks	1	0
Coaly blaes	2	0
Fireclay	3	9
COAL	1	6
Hard sandstone		

The coal seam was found to be comparatively undisturbed despite the fact that the Splint had been wrought out only 3 fathoms underneath.

At Meadowhead Pit the section is given as :—

	Ft.	In.
Rock more than	3	0
COAL	1	6
PARROT	0	$1\frac{1}{2}$
Fakes	0	6
Fireclay		

At Howmuir Pit :—

	Ft.	In.
Blaes		
Daugh	0	4
Blaes	0	2
COAL	0	2
Soft fireclay	0	9
COAL	0	4
Black fireclay	1	0
COAL	1	3
Faky fireclay		

The following section is seen on the bank of the South Calder Water, about one quarter mile north-west from Coltness Mains.

	Ft.	In.
Gassy shale	1	0
Fireclay	0	6
Fakes	0	3
COAL	0	3
Fireclay	0	3
COAL (hard splinty)	0	9
Fireclay	0	9
COAL	2	3
Sandstone	1	0

There can be no doubt that this is the Humph Coal, which has been wrought farther down the stream, and must have somewhat improved in thickness in this direction.

The whin float to which reference has already been made occurs at a level of 4 fathoms above the Humph Coal in the Howmuir pit. It is here thin, but must expand considerably to the north, as it is stated that both the Splint and the Main Coal come under its influence.

Main and Pyotshaw Coals.—These two coals appear as a general rule to form one seam in all of Lanark 12 N.E., and in Lanark 12 S.E., except for the south-west corner. Near the Tillanburn Manure Works the joint thickness is stated to have been 9 feet, while near South Lanridge the Main alone measured 5 ft. 3 in., not including a parting.

At Townhead No. 43 Pit (near Chapelknowe) what is probably the joint section is given as follows :—

	Ft.	In.
Fakes	3	0
COAL 6 ft. {	COAL	2 6
	FREE COAL	2 0
	SPLINT COAL	1 0
	COAL	0 6
Rock		

A section of the seam is well exposed on the south bank of the South Calder, near where the latter is joined by the Temple Gill. Here it is 7 feet in one division, with sandstone roof and fireclay pavement. At Meadowhead Coal Pit, however, only half a mile to the west, a 7-foot parting has come between the two components, the lower or Main Coal measuring 4 feet, and the upper or Pyotshaw 3 feet in thickness. This splitting is continued in the sheet to the

west, where, as we have stated (p. 61), the two are sometimes over 30 feet apart.

A 6-fathom "white clay sandstone" is shown in an old bore at Glencleland, between the Main and the Ell Coal. A yellow sandstone in this position was quarried to the north of Pickerstonhill.

Ell Coal.—The Ell Coal has all been wrought a first time, but, at the time of the revision, work was proceeding on a small scale, near Pickerstonhill, in the removal of "stoops." Here the section was :—

	Ft.	In.
Rock		
Fireclay	0	8
COAL, free	1	3
COAL, splint	0	8
COAL, free	0	10
COAL, slaty	0	3
Stone	0	7
BOTTOM COAL, free	1	8
Daugh	0	4
Rock		

At Townhead, No. 43 Pit, already referred to, 6 feet of coal was present, with a 4-inch parting near the base. At Glencleland Colliery there was 7 ft. 6 in. of coal, of which 2 feet was reckoned as "Head Coal" and 5 ft. 6 in. as "Ell Coal." Near Newmains the thickness was equally great, but included two thin partings. On the whole, however, this was an unusual thickness for the present district, though the seam appears in a general way to be thickening towards the south.

Seams above the Ell Coal.—The "Upper Ell" coal workings, near Highsethead, have already been referred to (p. 64). They extend a short distance into the present area, about half a mile to the south of Lauchope, but, as has been stated, it is probable that the seam was really the Ell Coal. A coal 12 fathoms above the Ell was however wrought as the "Upper Ell" from the old Greenside Pit, at Newhouse Colliery.

On the south bank of the Legbrannock Burn, just north of Newarthill, is the following section :—

	Ft.	In.
BLACKBAND IRONSTONE	0	8
Blaes over	3	0
COAL at least	2	0
Fakes and blaes	9	0
COAL 4 in. to	0	8
White fireclay	9	0
Fakes		

The thicker of the two coals has apparently been wrought. This seam would appear to be at least 20 fathoms above the Ell, and therefore probably on a higher horizon than the last referred to. A bore in the neighbourhood of Cleland shows that there is no coal there more than 7 inches in thickness, in the 50 fathoms of strata which overlie the Ell Coal. It is thus probable that these higher seams are of very local occurrence.

Among the highest strata which are met with anywhere in the district, are those cut into by the South Calder Water in the Ravenscraig gorge. Here we have:—

	Ft.	In.
Massive sandstone	40	0
Sandstone, with irregular lenticles of coal	6	0
Fakes and flaggy sandstone	6	0
COAL 1 ft. to	1	3
Fakes	25	0
Sandstone	30	0

This section must run approximately from 30 to 50 fathoms above the Ell Coal. There is no trace of reddening, and it is probable that the horizon of Skipsey's Marine Band is not attained.

Structural Features.—The general dip of the strata is to the west and south. Thus the highest measures in the district occur near Ravenscraig gorge. Beginning with the inlier of Millstone Grit, which has been described in a previous chapter (p. 11), altogether nearly 200 fathoms of strata have their outcrops within the area. The region is, however, one of rather intense faulting, and the succession is by no means regular. As in other parts of Lanarkshire

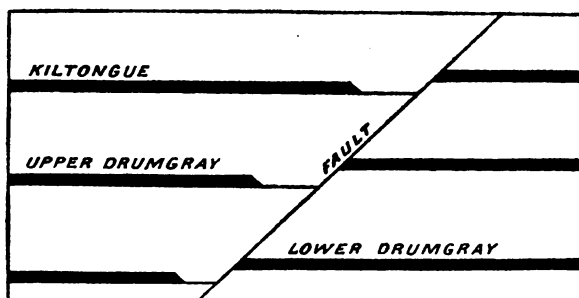


Fig. 4.—“Wants” in successive Coal Seams adjacent to a Fault, Spindleside Pit, Cleland.

the faults fall mainly into two classes, striking east and west, and south-east to north-west respectively. The east and west faults, without being actually the largest, are, perhaps, the most persistent. The largest fault in the two quarter-sheets appears to be the one which enters Lanark 12 S.E., near Chapelknowe, and has near No. 43 Townhead Pit a downthrow of 90 fathoms to the south-west, but it dies out comparatively quickly.

An interesting “want” occurs at Spindleside Pit, near Cleland. As is well known, wants often occur vertically, or almost vertically, above one another in successive coal seams. In this case the want is linear, running from west to east. It affects the Kiltongue, the Upper Drumgray and Lower Drumgray Coals, occupying a position progressively farther north in the two lower seams (*see* Fig. 4). Its southern margin is formed in all three cases by an east and west fault, with downthrow to the north of only a foot or two, with which the wants are in evident connection.

Intrusive Dolerite.—A whin float, or sill of intrusive dolerite, rises to the surface at Greenhill Farm, and has been wrought in

one or two small quarries. This is probably the float to which reference has been made in discussing the Humph and Splint Coal seams.

Buried River Channels.—In the Old Series Geological Survey Maps parts of two preglacial or interglacial channels are shown not far from Cleland. The revision of the area has, however, rendered it doubtful whether a channel of this nature runs past Cleland Townhead in the course assigned to it. It runs from the main railway to the Tillan Burn as indicated, but from thence there is reason to think it bends south-eastward, and is continuous with the one which crosses the South Calder Water east of Wishaw House, where the sand which fills it is seen on both sides of the stream. Whether this was the course of the Tillan or South Calder it is impossible to say, but we are here most likely dealing with a single interglacial stream, flowing towards the line of the present Clyde valley, in which direction it can be traced for over three miles (*see* p. 122).

A smaller buried channel was proved in the Main Coal to the north of Auchinlea. These river courses have been cut down into solid rock, and subsequently filled with sand and gravel, most likely in interglacial times. They were afterwards covered by boulder-clay, which, in the case of the small channel just referred to, is 20 feet thick in a railway cutting immediately above where the sand-bed was proved in the Main Coal. They are of importance as interrupting in some cases the working of the surface coals.

Future development of the District.—The following paragraph, quoted from the "Summary of Progress for 1911,"¹ sums up the status of the coalfield at the time of the Survey revision, more especially with regard to the thicker seams:—

"In this district the Ell Coal, the Main Coal, and the Splint have all been wrought a first time (on the stoop and room principle) over their entire area. In some cases the stoops have been removed in bulk, while in others a second, and in some cases a third system of rooms has been driven through them. Where any of these three coals remain it is in the form of narrow pillars, and in the case of the Ell Coal any attempt to work these is fraught with danger of spontaneous combustion. The Humph Coal is being wrought at one colliery in this district, and is not much disturbed in spite of the fact that the Splint Coal has been wrought out three fathoms below it. The Virtuewell Coal is also mostly out, and what coal is left in the district is mainly in the Kiltongue, Upper, Mid and Lower Drumgray Seams.² Of these the Kiltongue is usually thin, and although the Upper Drumgray is in places a good seam it is elsewhere hardly thick enough to form a workable subject. The Mid Drumgray is only present in any thickness near Newmains. It is the Lower Drumgray which is the most constant, and probably will be the greatest factor in the future development of this district."

A fairly large area exists round Cleland and Wishaw Houses, and round Coltness, in which these lower coals have not been wrought. There is one apparent record of a shaft having reached the Kiltongue; and one bore only proving the group of coals is known to

¹ *Mem. Geol. Surv.*, 1912, p. 53.

² This statement refers only to Coal-Measure seams.

the writer. This bore is from the bottom of No. 3 Pit, Cleland, and not far from the northern limit of the area. It gives the Kiltongue as 15 in., the Upper Drumgray as 7 in., and the Lower Drumgray as 1 ft. 8 in. in thickness. In the Quarry Bore, near Wishaw (Plate VI., Section 3), a little to the south of the area under consideration, the three coals are all poor. A little encouragement may be derived from the fact that what is taken in this Memoir to be the Upper Drumgray Coal is a workable subject at Coursington Colliery (Lanark 12 S.W.), and also in Shields Colliery, a little farther south (pp. 50 and 108). The Lower Drumgray measures 21 inches at Coursington, and there is a supposed equivalent at Belhaven (Over Johnston) Colliery. On the whole further boring is needed before a conclusion can be come to as to the reserves in this area, on the horizons of these lower coals.

A better case might be made out as regards the area occupied by higher strata, which extends for some distance on each side of the village of Newarthill. At Townhead No. 43 Pit, a little to the south of this area, the Lower Drumgray was wrought with a thickness of 22 inches, while the Upper Drumgray and Kiltongue Coals measured respectively 14 and 18 inches. At Legbrannock Colliery, just north of the area, and not far from Lauchope, both the Lower and Upper Drumgray Coals are workable subjects, the latter measuring 2 ft. 2 in. At Newhouse Colliery the former seam is 2 ft. 6 in. It is thus evident that nothing except the depth—or it may be difficulties with regard to water—has prevented the Lower Drumgray from being worked over this area. It would not be deeper than 120 fms.

With regard to the thinner seams there is in the first place little prospect that the Crofthead Coal will be wrought anywhere in the district except possibly near Easthill, if the coal there be in fact on that horizon. The Clefted Coal is thin but fairly constant over the northern and eastern part of the two sheets. Enough is not known as to its quality to justify a prediction as to whether it is likely to be wrought in the near future. The Shotts Gas Coal is even thinner.

The Virtuewell is fairly constant, and two bores near Meadowhead show it as 2 ft. and 2 ft. 5½ in. in thickness. It is therefore worth noting that there appears to be a good deal of ground in the south-western part of Lanark 12 S.E., where the seam is still intact. It is also quite possible (though the writer has no definite knowledge) that much of the Humph Coal may have been left while attention was being given to the thicker surrounding seams. If of as good quality, and as little influenced by underlying workings, as at Nos. 1 and 2 Pits, Glencleland, it is likely that this seam will be further exploited. The local presence of probably three thin coal seams, above the Ell, is also worthy of remembrance.

In conclusion it may be mentioned that, even if none of the thinner seams prove remunerative, the series of coals at present wrought,—from the Virtuewell to the Lower Drumgray,—will keep the coalfield a busy one for many years to come.

E. M. A.

CHAPTER V.

COAL MEASURES: HAMILTON AND WISHAW.

A. HAMILTON DISTRICT.

Including Lanark, 17 N.E., and 18 N.W. (south-west of the River Clyde).

THE Hamilton district is separated from that of Wishaw, to be described later, by the River Clyde between Ross House and Upper Carbarns. From Ross House the boundary runs westwards to Udston, and thence follows the line of the Dechmont fault in a south-easterly direction towards Meikle Earnock Station. The district includes by far the larger part of the town of Hamilton, and has long been an important and active mining centre.

The general succession in the Productive Coal Measures of the Hamilton District is shown in the following table. The names in brackets are those that have been adopted in the detailed description of the seams.

GENERAL SECTION OF PRODUCTIVE COAL MEASURES OF HAMILTON DISTRICT.

	Thickness.			Depth.		
	Fms.	Ft.	In.	Fms.	Ft.	In.
SKIPSEY'S MARINE BAND . . .	0	0	8		...	
Strata	28	0	0	28	0	8
UPPER COAL of MERRYTON, local						
Strata	5	3	0	33	3	8
COAL or coaly blaes . . up to	0	1	6	33	5	2
Strata	15	0	0	48	5	2
ELL COAL	1	2	0	50	1	2
Strata	7	3	0	57	4	2
PYOTSHAW COAL	0	3	0	58	1	2
Strata a few in. to 7 fms.	4	0	0	62	1	2
MAIN COAL	0	4	6	62	5	8
Strata	6	0	0	68	5	8
HUMPH COAL 1 ft. 11 in. to 3 ft.	0	2	6	69	2	2
Strata . . . 2 to 6 fms.	5	3	0	74	5	2
SPLINT COAL	0	5	6	75	4	8
Strata . . . 0 to 18 in.	0	0	3	75	4	11
VIRGIN COAL up to	0	1	1	76	0	0
Strata	12	3	0	88	3	0
BLACKBAND COAL	0	2	0	88	5	0
Strata	8	0	0	96	5	0
VIRTUEWELL COAL 12 to 35 in.	0	1	10	97	0	10
Strata	12	0	0	109	0	10
KILTONGUE MUSSELBAND SHALE .	0	0	10	109	1	8

Coal Measures.

	Thickness.			Depth.		
	Fms.	Ft.	In.	Fms.	Ft.	In.
Strata	6	0	0	115	1	8
COAL (KILTONGUE)	0	1	3	115	2	11
Strata 1 to 2½ fms.	1	3	0	116	5	11
COAL (LOWER KILTONGUE)	0	0	8	117	0	7
Strata	5	3	0	122	3	7
"KILTONGUE" COAL (UPPER DRUMGRAY)	0	2	0	122	5	7
Strata 1 fm. to	2	0	0	124	5	7
Fireclay with one or two thin coals (MID DRUMGRAY)	1	0	0	125	5	7
Strata	4	0	0	129	5	7
"UPPER DRUMGRAY" COAL (LOWER DRUMGRAY)	0	1	6	130	1	1
Strata with a few thin coals	35	0	0	165	1	1
Conjectural Base of Coal Measures						

The collieries at present working in the Hamilton district and the seams mined are shown in the following table :—

Colliery.	Owners.	Seams worked.
Udston	Udston Colliery Co., Ltd.	Blackband.
Earnock	John Watson, Ltd.	Ell, Pyotshaw, Main, Humph, Splint, Blackband and Kiltongue.
Neilsland		
Bent	Bent Colliery Co., Ltd.	Humph, Blackband, Virtue- well and Kiltongue.
Cadzow	Cadzow Coal Co., Ltd.	Pyotshaw, Humph, Splint, Virtue- well and Kiltongue.
Ross	A. Russell, Ltd.	Ell, Pyotshaw, Main, Humph, Splint, Blackband and Virtue- well.
Ferniegair		
Allanton	W. Barr & Sons, Ltd.	Ell, Pyotshaw, Main, Splint, Blackband, Virtue- well and Lower Drumgray.
Bog	Hamilton, M'Culloch & Co., Ltd.	Ell, Pyotshaw, Main, Splint, Virtue- well and Lower Drumgray.
Home Farm	" " "	Humph, Blackband, Kiltongue and Lower Drumgray.

The thinner seams in several abandoned fields are now wrought from adjoining collieries.

The Splint Coal is an excellent seam for furnace and manufacturing purposes, but unfortunately very little of it is now left. Characteristically it contains a rib of gas coal, about 7 to 9 inches thick. The "Kiltongue Coal" of Hamilton (*see* p. 90) is hard and splinty in nature, and furnishes a good steam-raising and manufacturing fuel. The other seams are mainly household coals.

Base of Coal Measures to Lower Drumgray Coal.—No coals of workable thickness are known to occur in the Coal Measures of the Hamilton district below the seam which we have tentatively designated the Lower Drumgray. The sequence is shown in a generalised form in Plate VI., Section 1, and little need be added to the data given there. No horizon corresponding to the Slatyband Ironstone has yet been recorded in any boring, and consequently the

selection of a base-line to the Coal Measures is very largely arbitrary. Some five fathoms below the Lower Drumgray there is very constantly found a thin coal which may perhaps represent the Watstone Musselband of the Larkhall District.¹ This musselband there lies $4\frac{1}{2}$ fathoms under the Lower Drumgray, and is tentatively correlated with the Shotts Gas Coal, which in some localities at least is known to have "mussels" in the blaes above it. As far as the Hamilton district is concerned, however, there is no record of a musselband at the horizon referred to. Six to nine fathoms lower in the sequence another thin coal occurs in the position, approximately, of the Upper Slatyband Ironstone of Cherryhill,² which is probably to be correlated with the Mill Coal of the Armadale coal group.

KILTONGUE—DRUMGRAY COAL GROUP.

A good deal of confusion has crept into the nomenclature of this group of coals. Reference has been made in a previous chapter (see page 50) to the working of the Kiltongue Coal at Motherwell, and at Dalzell or Coursington Collieries, the former lying to the west, the latter to the east, of the town of Motherwell. Reasons were there advanced for believing that the Kiltongue Coal of these localities is in reality the Upper Drumgray of districts farther north and east. It is also evident that the coal wrought near Motherwell as the Kiltongue is the same as the seam worked under this name at several collieries near Hamilton. This can be shown, for example, by a comparison of a boring at Motherwell Colliery with bores at Ross, Barncluith, Bent, Cadzow, Neilsland, and Udston. We therefore prefer to regard the so-called Kiltongue of the collieries mentioned as the equivalent of the Upper Drumgray of such districts as Airdrie, Newmains, Wishaw, etc. The following table, which gives the sequence at different places in the Hamilton area, is inserted as an illustration of our point of view:—

	Ross.	Barncluith.	Bent.	Cadzow.	Udston.
SPLINT COAL . . .	...	...	...	...	...
Strata . . .	$13\frac{1}{2}$ fms.	$13\frac{1}{2}$ fms.	12 fms.	12 fms.	9 fms.
BLACKBAND COAL . . .	26 in.	25 in.	27 in.	28 in.	24 in.
Strata . . .	$7\frac{1}{2}$ fms.	7 fms.	9 fms.	$8\frac{1}{2}$ fms.	7 fms.
VIRTUEWELL COAL . . .	24 in.	15 in.	18 in.	18 in.	in leaves.
Strata . . .	$12\frac{1}{2}$ fms.			12 fms.	9 fms.
Position of KILTONGUE MUSSELBAND . . .	2 ft. shaly blaes 6 fms.	18 fms.	17 fms.	8 in. shale 5 $\frac{1}{2}$ fms.	15 in. shaly blaes 9 fms.
COAL (UPPER KIL- TONGUE) . . .	11 in.	13 in.	13 in.	12 in.	14 in.
Strata . . .	2 fms.	$1\frac{1}{2}$ fms.		2 fms.	$1\frac{1}{2}$ fms.
COAL (LOWER KIL- TONGUE) . . .	5 in.	4 in.	7 fms.	9 in.	15 in.
Strata . . .	$4\frac{1}{2}$ fms.	6 fms.		$3\frac{1}{2}$ fms.	3 fms.
"KILTONGUE" COAL (UPPER DRUMGRAY)	18 in.	19 in.	33 in.	29 in.	20 in.

¹ See "Econ. Geol. Central Coalfield, Area VIII." (*Mem. Geol. Surv.*), 1917, pp. 37 and 40.

² *Op. cit.*, p. 39.

In none of these borings are "mussels" recorded at the Kiltongue Musselband horizon, but the shale itself is constantly noted, and there is no doubt of the correct identification of the position.

The lowest coal of the table given above is wrought as the Kiltongue, at Bent, Cadzow and Neilsland, and has recently been abandoned at Udston. Three arguments may be adduced in support of the view that it is really the equivalent of the Upper Drumgray.

(1) The distance between this so-called Kiltongue Coal and the Kiltongue Musselband in the Hamilton area varies from $10\frac{1}{2}$ to 13 fathoms, as compared with 5 or 6 fathoms in such districts as Airdrie, Fauldhouse, Newmains, Wishaw, etc.

(2) At Hamilton a somewhat variable coal is found a few fathoms above the so-called Kiltongue in the position of the Kiltongue Coal proper. As the table shows, it is frequently in two thin leaves, $1\frac{1}{2}$ to 2 fathoms apart, which seem to correspond to the Kiltongue and Lower Kiltongue (or Jewel Coal) of Larkhall. We may note also that in the Quarter field, to the south of Hamilton, the Kiltongue Coal, lying some 7 to 8 fathoms under the Musselband, is poorly developed, and may even be wanting over considerable areas.

(3) The "Kiltongue" Coal wrought near Hamilton is of a hard splinty nature.

On the view that this seam is really the equivalent of the Upper Drumgray, the coal constantly occurring some 7 fathoms lower in the sequence, and referred to in borings under that name, ought to be termed the Lower Drumgray.

As regards the eastern part of Lanark 18 N.W., no exact correlation of the seams below the Kiltongue Musselband has yet been established. This uncertainty arises from several causes. There is greater variation here in the intervals between the coals of the Kiltongue-Drumgray Group, while the group as a whole shows in general a considerable attenuation as it is followed eastwards towards Larkhall. Further, in some critical areas we have little or no information regarding these lower seams, while in at least one instance the same coal has been wrought at different periods under different names. One important point that awaits explanation is the apparent disappearance on the south-west side of the Clyde of the Mid Drumgray Coal of Garriiongill, which corresponds to the Low Coal of Shotts. It may possibly be the case that the Lower Drumgray of Bog, Home Farm, and Allanton Collieries represents the Mid Drumgray, but there is not sufficient evidence yet available to settle the point.

Lower Drumgray Coal.—About 7 fathoms below the "Kiltongue" Coal wrought at Bent, Cadzow, Neilsland and, until recently, at Udston, there is very constantly present a somewhat variable seam which is known locally as the "Upper Drumgray," but which, as already explained, we prefer to regard as the equivalent of the Lower Drumgray. The coal referred to can generally be recognised in borings by the fact that it is overlain by several feet of blaes containing ribs and balls of clayband ironstone. In a bore at Ross Colliery it is recorded as a "wild parrot," $2\frac{1}{2}$ feet thick. At Barncluith and Cadzow its thickness in borings is 17 and 19 inches

respectively. Westwards it thins however; at Fairhill and Eddlewood it is 13 inches in thickness; at Udston 12 inches.

The strata between the seam just mentioned and the coal wrought as the Kiltongue consist mainly of hard fakes and sandstones, but include a fairly constant horizon of coal and coaly blaes. This coal is frequently in leaves separated by partings of fireclay. Three sections may be given :—

BORE AT ROSS COLLIERY.				BORE AT CADZOW COLLIERY.			
		Ft.	In.			Ft.	In.
COAL	.	0	6	COAL	.	0	8
Faky fireclay	.	1	9	Fakes and blaes	.	3	7
COAL	.	0	2	COAL	.	0	11
Faky sandstone	.	7	0	Fireclay and fakes	.	3	3

BORE AT UDSTON COLLIERY.					
		Ft.	In.		
COAL	.	0	2		
Faky fireclay	.	0	6		
COAL	.	0	3		
Faky Fireclay	.	2	10		

This coal may be tentatively termed the Mid Drumgray.

"Lower Drumgray" of Allanton, Home Farm, and Bog Collieries.—A coal seam is mined under the name of the Lower Drumgray at the three collieries mentioned. Its relation to the Virtuewell Coal is shown in the following table :—

	ALLANTON.	Bog.
VIRTUEWELL COAL	...	...
Strata	13 fms.	12 fms.
KILTONGUE MUSSELBAND	12 in.	10 in.
Strata	4 fms.	5 fms.
COAL (KILTONGUE COAL)	15 in.	14 in.
Strata	6 fms.	6 fms.
COAL (UPPER DRUMGRAY)	6 to 22 in.	6 to 18 in.
Strata	3 to 7 fms.	4½ fms.
"LOWER DRUMGRAY COAL,"	with parting, up to 29 in.	up to 29 in.

The "Lower Drumgray" of Bog Colliery shows :—

	Ft.	In.
Sandstone	1	6
COAL	1	11
Rib	0	1
COAL	0	6

At Home Farm it is said to reach along with its parting a thickness of 39 inches. At Allanton, where the same seam has recently been opened out, a boring showed :—

	Ft.	In.
COAL	1	5
Coaly blaes	1	3
COAL	1	0

The coaly blaes may be as much as 3 feet thick, however, and the lower leaf of coal completely absent. In the same colliery the undoubted Upper Drumgray is also wrought, and the distance between the seams is said to be as much as 40 feet in a blind pit, though in borings it amounts to only 14 or 15 feet. There is some reason for believing that the "Lower Drumgray" of Allanton, Home

Farm, and Bog, may in reality represent the Mid Drumgray, which, as has been explained, is also possibly present nearer to Hamilton.

Upper Drumgray Coal ("Kiltongue" Coal of Hamilton).—The undoubted Upper Drumgray Coal has quite recently been opened out at Allanton Colliery, where it varies in thickness from 6 to 22 inches. It is said to be a harder and cleaner coal than the Lower Drumgray of the same colliery (*see* p. 89). It lies about $10\frac{1}{2}$ fms. below the Kiltongue Musselband, and about $23\frac{1}{2}$ fms. below the Virtuewell Coal. In borings at Ferniegair Colliery an 11- or 12-inch coal is recorded at the same horizon.

Under the name of Upper Drumgray we propose to deal also with the "Kiltongue" Coal of certain collieries near Hamilton. Some of the reasons for the adoption of this nomenclature have already been given and need not be repeated. The coal referred to is wrought at present at Bent, Cadzow, and Neilsland, where it lies 22 or 23 fms. below the Virtuewell. At Bent and Cadzow it shows:—

BENT.				CADZOW.			
		Ft.	In.			Ft.	In.
Black blaes	.	0	5	Dark fakes	.	0	8
SPLINT COAL	.	2	6	HARD COAL	.	2	1
GAS COAL	.	0	3	GAS COAL	.	0	4
Coaly blaes	.	0	2	Faky fireclay	.	1	6

At Neilsland the "Kiltongue" Coal is stated to occur in two leaves:—

		Ft.	In.
COAL	.	1	7
Stone rib	.	0	3
COAL	.	0	4

but here and in the Eddlewood field borings record considerable variations in thickness. Sometimes the rib is not present, and the coal appears to vary from 16 to 28 inches.

Westwards the seam deteriorates, and although mined for some years at Udston Colliery, was abandoned in December of 1917 as too thin for profitable working. Bores put down previous to the opening out of the seam had recorded as much as 24 inches of coal, but this thickness was not reached in the actual workings. A characteristic section of the Udston "Kiltongue" at its best showed:—

		Ft.	In.
Sandstone roof			
Blaes	.	0	9
COAL	.	1	8
Dirt.	.	0	1
COAL	.	0	2
Dirt.	.	0	1
Fireclay	.	0	11

The seam lies about 23 fms. under the Virtuewell Coal.

Wherever this Hamilton "Kiltongue" Coal has been wrought it has proved to be of a somewhat splinty nature.

From the foregoing data it seems likely that the "Kiltongue" Coal is a workable subject over all the eastern half of Lanark 17 N.E. A boring at Barncluith Colliery records 19 inches of coal lying 26 fms. below the Virtuewell, and another at Ross Colliery (Lanark 18 N.W.), shows an 18-inch seam at the same horizon.

West of Hamilton, however, the "Kiltongue" appears to be thinner and more variable than at Bent and Cadzow. Its development at Udston has already been referred to. In the Earnock field, which lies between Bent and Udston, there is some dubiety regarding the stratigraphical position of the coal wrought as the Kiltongue. It will accordingly be separately treated.

Kiltongue Coal of Earnock.—This seam occurs in No. 1 Pit, Earnock Colliery, at a depth of 161 fms., and lies some 19 fms. under the Virtuewell Coal. It is sometimes referred to as the Upper Kiltongue, and is locally considered to lie a few fathoms above the "Kiltongue" of Bent. If so, it may be a leaf of the true Kiltongue Coal (*see table on page 87*), which has in this locality attained a workable thickness. Its section is very similar to the Kiltongue Coal of Udston, and is given below:—

	Ft.	In.
Sandstone		
Fakes	0	9
COAL	1	8
Daugh	0	1
COAL	0	3
Daugh	0	1

Kiltongue Coal.—The seam which we prefer to correlate with the Kiltongue Coal of other districts, where the sequence and nomenclature are well-established, lies on an average 4 or 5 fms. above the so-called "Kiltongue" of Hamilton. It is a rather poor and variable seam, often divided into leaves by partings of fireclay. Near Hamilton, if we except the somewhat doubtful instance of the seam wrought under this name at Earnock Colliery (*see preceding paragraph*), it has attracted no attention. At Barncluith and Bent it is recorded as 13 inches thick, at Udston as 14 inches, and one or two fathoms lower there occurs a second somewhat thinner seam, which may perhaps correspond to the Lower Kiltongue or Jewel Coal of Larkhall. As examples of the splitting of the Kiltongue Coal by fireclay partings, the following two sections may be quoted:—

CADZOW.				EDDLEWOOD.			
	Ft.	In.			Ft.	In.	
COAL	1	0		COAL	7 in. to	0	10
Fireclay	4	9		Fireclay	2 in. to	0	6
Blaes	0	6		COAL	4 in. to	0	7
COAL	0	4		Faky fireclay	5½ ft. to	7	5
Faky fireclay	3	0		COAL		0	9
Blaes	2	8					
COAL	0	9					

At Ross Colliery an 11-inch coal is recorded 6 fathoms under the Kiltongue Musselband position; in two borings at Ferniegair the same seam is said to be 16 and 17 in. thick respectively. At Allanton the coal regarded locally, and probably rightly, as the Kiltongue has not yet been wrought, but where met with in roadways, etc., is about 15 in. thick. At Home Farm, where the seam is at present worked, it shows a thickness of 23 inches.

Kiltongue Musselband.—It is certainly curious that none of the borings near Hamilton record "mussels" at this horizon. Neverthe-

less its position can be generally recognised throughout the district by an 9 or 10-inch band of shale locally accompanied by a rib of clayband ironstone, one or two inches thick. The sections at Bent and Cadzow are as follows:—

BENT.		Ft. In.		CADZOW.		Ft. In.	
Sandstone				Sandstone			
Dark blaes	.	.	0 8	Dark blaes	.	.	0 8
SHALE	.	.	0 10	SHALE	.	.	0 9
Fireclay				CLAYBAND	.	.	0 2
				Fireclay			

Occasionally a thin coal is found in association with the shale. At Bog Colliery a 10-inch "musselband" is recorded at this horizon, below 4 inches of black shaly blaes.

The Kiltongue Musselband or Shale lies on an average 6 fathoms above the coal or coals we have taken as corresponding to the Kiltongue. The strata separating it from the Virtuewell Coal vary in thickness from 9 to 13 fathoms, and consist mainly of fakes and sandstones. Towards the middle of this interval there is found near Hamilton a fireclay horizon which may possibly correspond to the underseat of the Ladygrange Coal of other districts. The coal itself is by no means always present, though it measures 13 inches in a bore at Neilsland Colliery, and apparently 19 inches in another at Bog Colliery.

Virtuewell Coal.—This seam is best developed in the eastern part of the Hamilton district, where it is a valuable seam with the character of a first-class household coal. Westwards towards Hamilton, however, it becomes notably thinner, and is quite unworkable at Udston.

The Virtuewell Coal was in 1917 wrought at Bog, Allanton, Ferniegair, and Ross Collieries, and has also been worked at Home Farm Colliery. At the last-mentioned it showed:—

	Ft.	In.
Blaes	2	3
Clayband Ironstone balls	0	3
Blaes	0	3
Fireclay	0	7
Blaes and balls	0	3
COAL	2	6
Fireclay		

In the Allanton field the seam varies from 25 to 30 inches, rarely reaching 35 inches. At Ferniegair it is 23 inches thick, and has a sandstone roof. At Ross Colliery it varies from 18 to 23 inches.

In Lanark 17 N.E., the Virtuewell has been wrought at Bent and Cadzow since 1914 and 1916 respectively. The sections are as follows:—

BENT.		Ft. In		CADZOW.		Ft. In.	
COAL	.	.	0 6	COAL	.	.	0 6
Blaes and balls	.	.	4 4	Faky blaes	.	.	2 7
FREE COAL	.	.	0 4	COAL	.	12 in to	1 7
SPLINTY COAL	.	.	0 8	Faky Fireclay			
FREE COAL	.	.	0 6				
Fireclay							

On a small scale the Virtuewell Coal has also been worked at Neilsland (1911-12), where it showed:—

COAL	.	.	.	.	4 or 5 in.
Fireclay	.	.	.	.	15 to 20 in.
COAL	.	.	.	.	17 to 20 in.

This tendency to splitting is shown also at Eddlewood, where the lower leaf is only 15 inches or so thick. A boring at Allanshaw Colliery records at this horizon:—

					In.
COAL	.	.	.	.	8
Fireclay	.	.	.	.	5
COAL	.	.	.	.	7

At Barncluith, again, a blind bore recorded only 15 in. of coal in the same position. In the Earnock field it appears to range from 16 to 24 inches in thickness, and here, as elsewhere near Hamilton, has a variable fireclay parting. At Udston, as we have already seen, it is unworkable.

From the above data it would appear that from Hamilton southwards there is a considerable area of practically untouched Virtuewell Coal. It occurs here in two leaves, of which the lower and thicker varies from 15 to 20 inches. Farther east, however, it thickens considerably, and has been largely worked in Lanark 18 N.W. There is still much of it left here between the various colliery workings referred to.

The *Roughband Ironstone* is in general unrepresented in the district. Occasionally a bed of fireclay containing ironstone ribs is found about 2 fathoms above the Virtuewell Coal; and ironstones, 4 and 6 inches thick, are recorded in this position at Earnock.

Blackband Coal.—This seam has been mined for a number of years at Udston and Earnock Collieries, and was opened out at Bent and Cadzow in 1910. Its distance below the Splint Coal varies from 9 to 13 fathoms, and is greatest in the eastern part of the district. At Udston the Blackband Coal is 2 ft. thick, at Earnock 2 ft. to 2 ft. 4 inches, while the average section at Bent shows:—

		Ft.	In.
Dark blaes			
SPLINT COAL	.	0	1
FREE COAL.	.	2	2
Fireclay			

A bore at Barncluith records a thickness of 25 in., while at Ross Colliery the seam has the following section:—

		Ft.	In.
Sandstone			
Fireclay	.	4	0
COAL	.	2	2
Hard fireclay	.		

It has not been wrought between Bent and Ross Collieries.

South-east of Hamilton the Blackband Coal is raised at Ferniegair, Allanton, Home Farm, and Bog Collieries. It was first opened out in this part of the area at Ferniegair in 1911. In the Allanton

workings the thickness varies from 22 to 27 in.; at Merryton it occurs in three leaves, the section given in a boring being as follows:—

	Ft.	In.
COAL	0	10
Black blaes	0	9
COAL	0	6
Fireclay	0	2
COAL	1	6

The seam is also in leaves at Home Farm Colliery, where there is a total thickness of about 2 ft. 3 in. of coal.

In all the areas hitherto mentioned the Blackband is fairly constant in thickness, and, under present conditions, a workable subject. In the southern part of Lanark 17 N.E., it is a thinner and more variable seam. As already stated, it was opened out at Cadzow in 1910, but proved to be too variable and poor to work, and was soon abandoned. In the Neilsland-Eddlewood field it seems to vary from 1 to 2 ft. in thickness. Accordingly, little is likely to be done in this part of the Hamilton field in mining the Blackband Coal until the thicker and more constant seams are exhausted.

The strata between the Blackband and Splint Coals increase rather noticeably in an easterly direction in this district, from 9 to 13 fms. Towards the middle of the interval occurs a thin coal, 2 to 9 in. thick, which may perhaps represent the Musselband Coal of other areas. About 7 fms. under the Splint in a bore at "Avonbank Pit," near Avonbrae Cottages, a 2½-inch mussel-ironstone is noted lying 1 ft. above a 3-inch coal. At Bent No. 3 Pit a 6-inch musselband is recorded 10 ft. below the Splint.

Splint and Virgin Coals.—These coals in the Hamilton district form practically one seam which has nearly all been wrought out a first time by the "stoop and room" system. The removal of the old stoops or pillars is still in progress at the following collieries:—Earnock, Neilsland, Cadzow, Ross, Ferniegair, Allanton, and Bog One or two typical sections may be placed on record.

UDSTON.		BENT.	
	Ft. In.		Ft. In.
SPLINT COAL	2 0	FREE COAL	0 4½
FREE COAL	1 2	SPLINT COAL	1 8½
Parting	0 0½	GAS COAL	0 7
FREE COAL	0 6	FREE COAL	1 3
Parting	0 0½	Parting	0 0½
FREE COAL (VIRGIN)	3 0	FREE COAL	1 8
		Parting	0 3
		FOUL COAL (VIRGIN)	1 2

In these sections the Virgin Coal of Udston seems to be represented by the three lowest items at Bent. At Barncluith and Cadzow, again, the Splint Coal shows:—

BARNCLUITH.		CADZOW.	
	Ft. In.		Ft. In.
FREE COAL	0 3½		
SPLINT COAL	2 0	SPLINT COAL	2 1
GAS COAL	0 9	GAS COAL	0 7
FREE COAL	0 9	FREE COAL	3 0
Parting	0 1	Parting up to	1 5
FREE COAL (VIRGIN) 1 ft. 9 in. to	2 0	FREE COAL (VIRGIN)	1 0

The Virgin Coal of the Cadzow section corresponds to that at Bent, but certainly not to the seam of the same name at Barncluith. The name Virgin Coal appears to be somewhat loosely used. At Eddlewood the section is very similar to that at Cadzow and shows:—

	Ft.	In.
SPLINT COAL	1	11
GAS COAL	0	9
FREE COAL	2	10
Parting of fireclay	1	0
FREE COAL (VIRGIN)	1	0½

Farther south again in the Quarter field the parting may increase to as much as nine feet.

In Lanark 18 N.W. (south of the Clyde), the Splint and Virgin Coals form one seam with an average thickness of 5 ft. 3 in. The section at Home Farm Colliery may be quoted here:—

	Ft.	In.
Sandstone		
Blaes	2	6
Coaly blaes	0	7
FREE COAL	0	9
SPLINT COAL	1	5
FREE COAL	0	6
GAS COAL 1 ft. to	1	7
FREE COAL	1	1

The roof of the Splint Coal consists typically of blaes containing scattered ironstone balls. The seam itself is fairly constant throughout the district. The rib of gas coal is very characteristic; in some cases it was picked out and separately sold. The hard splinty nature of the upper part of the seam created a large demand for it for furnace and manufacturing purposes.

The strata which separate the Splint Coal from the Humph vary from about two fathoms at Udston to nearly six at Neilsland. They maintain an average thickness not much inferior to that at Nielsland throughout the whole of the eastern part of the district.

Humph Coal.—The Humph Coal lies above the Splint at a distance varying from 14 feet at Udston to about 6 fathoms at Blantyre. At Bent the distance is 4 fathoms, at Cadzow and Barncluith 4½ fathoms, and farther east in Lanark 18 N.W. it averages 5 fathoms.

The coal itself has been pretty extensively wrought in the northern part of Lanark 17 N.E. It is still raised at Earnock, Bent, Neilsland and Cadzow Collieries. At Udston, where the seam was abandoned in 1917, the Humph Coal showed.

	Ft.	In.
Blaes roof		
Blaes brushing	3	0
FREE COAL	3	0
Coaly blaes	0	6
Hard fireclay pavement		

The sections at Bent, Barncluith and Cadzow may also be quoted.

BENT.		Ft. In.		BARNCLUITH.		Ft. In.	
Blaes roof				Blaes roof			
Blaes with fireclay ribs .	3	3		Blaes	.	3	0
COAL	2	10		COAL	.	0	4
Fireclay pavement				Scit	.	0	0½
				COAL	.	2	0
				Blacks			
CADZOW.							
					Ft. In.		
Black blaes .	.	.	.	.	4	9	
COAL	.	.	.	.	0	6	
Dirt	.	.	.	0 to	0	3	
COAL	.	.	.	.	1	11	
Fireclay pavement							

Near Fairhill the Humph Coal is 26 or 28 inches thick, and farther west may reach 36 inches. At Earnock it is about 2 ft. 8 in. in thickness, and on Wellhall varies from 2½ to 3 feet. There is still a considerable area of Humph Coal to be exploited to the south of Hamilton in the Neilsland, Eddlewood and Cadzow fields, although the seam decreases in thickness in this direction, and farther south at Quarter has little or no economic value. East of Barncluith and Cadzow it is a somewhat variable coal, but is still wrought at Ross and Ferniegair. The section at the latter colliery shows:—

	Ft.	In.
Blaes and ironstone ribs		
COAL	0	7
Rib	0	2
COAL	1	8
Fireclay		

A bore at Allanton Colliery records 32 inches of coal in the Humph position. At Home Farm Colliery the section shows:—

	Ft.	In.
Coaly blaes	0	4
COAL	0	4
Scit	0	4
COAL	1	6

At Merryton also it occurs in two leaves, of which the upper is rather thicker than at Home Farm. At Bog Colliery again it is stated to consist mainly of ribs of coal, 1 to 2 inches thick, separated by one-inch dirt partings. Unless similar partings have been unrecorded in other bores it would appear that there is a good deal of ground within Lanark 18 N.W., where the Humph is of a workable character.

Main Coal.—This coal in the Hamilton district shows a very uniform thickness of about 4 ft. 6 in. A few typical sections of the seam may be placed on record:—

	BARNCLUITH.		BENT.		FAIRHILL.		CADZOW.	
	Ft.	In.	Ft.	In.	Ft.	In.	Ft.	In.
FREE COAL	1	0	1	0	1	3	1	0
SPLINT COAL	0	3	0	3	0	3	0	2
FREE COAL	1	11	2	0	1	10	1	10
SPLINT COAL ("Pugs") .	0	9	0	8	0	7	0	6
FREE COAL	0	6	0	9	0	6	0	9

The roof consists typically of fakes, though locally a little blaes may occur immediately above the coal.

In Lanark 18 N.W. (south of the River Clyde), the section of the Main Coal is very similar to those given above. We quote the following details of its development at Ferniegair and Home Farm Collieries:

FERNIEG AIR.			HOME FARM.		
	Ft.	In.		Ft.	In.
Blaes and balls			Faky sandstone roof		
FREE COAL . . .	1	2	FREE COAL . . .	1	1
SPLINT COAL. . .	0	3	SPLINT COAL. . .	0	3
FREE COAL . . .	1	10	FREE COAL (1-in. rib in centre) . . .	1	11
SPLINT COAL. . .	0	8	SPLINT COAL. . .	0	6
FREE COAL . . .	0	9	FREE COAL . . .	0	8

The strata intervening between the Main and Ell Coals average 11 or 12 fathoms in thickness, although at Blantyre No. 3 Pit the distance is stated to be only $8\frac{1}{2}$ fathoms. In this interval occur two horizons that call for particular notice—the Pyotshaw Coal and the representative of the well-known “Cambuslang Marble.”

Pyotshaw Coal.—This seam is wrought at present at nearly all the working collieries in the district. Its distance above the Main Coal varies from a few inches up to 44 feet. In some parts of the field the variation in thickness of the intervening beds is very rapid; at Bog and Home Farm Collieries, for example, it is said that an increase from a few inches up to four or five fathoms may occur in 100 yards or less. The following table records the figures for different localities:—

PYOTSHAW TO MAIN COAL.

Name of Shaft or Boring.		
Blantyre Colliery (Nos. 2 and 3 Pits) . . .		17 to 25 ft.
Udston ” No. 1 Pit		18 ft.
Earnock ” No. 1 Pit		21 ft.
Allanshaw ” No. 1 Pit		16 ft.
Bent ” No. 1 Pit		10½ ft.
Fairhill ” No. 2 Pit		11 ft.
Neilsland ” No. 1 Pit		24 ft.
Barncluith ” No. 1 Pit		28 ft.
Ross ” No. 2 Pit		30 ft.
Bore in No. 1 Pit, Ferniegair		44 ft.
Allanton Farm, No. 2 bore		36 ft.
Merryton, No. 1 bore		29 ft.
Highlees Farm, bore on		7 ft.

The average thickness of the coal itself is about 36 inches. At Udston it increases to as much as 50 inches, and at Allanton falls to 27 inches. Typically the roof is of faky blaes and the pavement of fireclay. A few characteristic sections are added:—

	UDSTON.		BENT.		BARNCLUITH.		ALLANTON.	
	Ft.	In.	Ft.	In.	Ft.	In.	Ft.	In.
FREE COAL	0	7	1	0	1	5	0	10
SPLINT COAL	3	0	2	6	1	7	1	5
FREE COAL	0	7	0	9	0	2	...	

At Earnock it varies from 39 to 45 inches in thickness and the roof is of fakes.

The other horizon referred to is a "musselband," 8 or 10 inches thick, which was got in Earnock Colliery some two fathoms above the Pyotshaw Coal. This bed represents the "Cambuslang Marble" described on page 36 of this Memoir. It has not often been recorded outside the type district, nor do the "mussels" occur anywhere else in such profusion or in such a good state of preservation as at Cambuslang.

Ell Coal.—Coal is still obtained from stoops in the old workings in this seam at Earnock and Neilsland Collieries, but the seam is practically exhausted so far as the Hamilton area is concerned. It averaged 7 or 7½ feet in thickness. A typical section is that recorded for the abandoned colliery at Allanshaw:—

	Ft.	In.
Sandstone	20	0
Hard fireclay	4	0
HEAD COAL	1	6
{ COAL	4	0
{ Stone	0	1½
{ COAL	1	6
Fireclay	6	0

The bracket indicates the worked part of the seam.

The coal was wrought here on the "stoop and room" system, with pillars of 20 by 30 yards. The section at Udston is somewhat different, and shows:—

	Ft.	In.
Sandstone		
Fireclay	6 to	8
COAL		0
Sclit		4
WILD COAL		8
		0 1½
		7

The upper portion of the seam, variously described as "head coal," "top coal," "brassy coal" (Eddlewood), or "inferior coal" (Bent), was left in as support to the workings. This custom arose from the fact that the overlying blaes or fireclay did not furnish a good roof to the seam, but it has in some cases been found possible to obtain the coal thus left in a second working. Around Hamilton the "head coal" varied from 1½ to 2½ feet. The part actually wrought, or the "breast coal," was about 5 to 5½ feet thick, and at least locally contained ribs of a splinty nature. One or two sections may be given:—

BENT.		CADZOW.	
	Ft. In.		Ft. In.
INFERIOR COAL	1 6	HEAD COAL	2 0
SOFT COAL	2 0	COAL	1 8
SPLINT COAL	0 9	HARD COAL	0 6
FREE COAL	3 0	SOFT COAL	3 4
EDDLEWOOD.			
BRASSY COAL			1 10
SPLINT COAL			0 2
FREE COAL			1 10
SPLINT COAL			0 4
FREE COAL			1 8
SPLINT COAL			0 1
FREE COAL			1 4

In Lanark 18 N.W. (south of the R. Clyde) the Ell Coal is still raised at Ross, Ferniegair, Allanton and Bog Collieries. Its average thickness here is $8\frac{1}{2}$ feet. The following table shows the proportion of "head" to "breast" coal at different points:—

	Head Coal.	Breast Coal.
Barncluith	1 ft. 8 in.	5 to $5\frac{1}{2}$ ft.
Haughhead	$2\frac{1}{2}$ ft.	5 ft.
Ferniegair	2 ft. 3 in.	5 ft.
Merryton	3 ft.	4 ft. 4 in.
Bog and Home Farm .	3 ft.	5 ft. 4 in.

The breast coal has again a thin splint rib of about 6 inches in thickness. In this part of the Hamilton area also the seam is rapidly nearing exhaustion. At Merryton and Home Farm Collieries it was found possible to open up the head coal as a new seam.

Strata above the Ell Coal.—The beds intervening between the Ell Coal and Skipsey's Marine Band in the Hamilton district contain no index-horizon of any stratigraphical value. A few thin and inconstant seams of coal are locally recorded, but the evidence at our disposal is not sufficient to allow of any satisfactory correlation with other districts. Near Hamilton a thin coal or coaly blaes horizon, which may locally be as much as 14 inches in thickness, occurs some 11 or 12 fathoms above the Ell. This seam may perhaps correspond to the "Upper Coal" of the Glasgow district, which was worked about two and a half miles to the north-west at Letterick in Lanark 11 S.W. (*see* p. 40).

At Ross Colliery, No. 2 Pit, an 18-inch coal is recorded some 16 fathoms above the Ell Coal.

A small area of "Upper" or "Upper Ell" Coal has been wrought at Merryton. This seam lies 22 fathoms above the Ell, and showed the following section:—

	Ft.	In.
Dirt	0	6
COAL	0	4
Daugh	0	6
COAL	0	11
Faky plies, brushing	2	6

In a boring at Highlees Farm (south-east corner of Lanark 18 N.W.) what is almost certainly the same horizon showed:—

	Ft.	In.
Sandstone fakes	3	6
SOFT COAL	1	0
Fireclay	1	2
COAL	0	6
Faky fireclay	3	0

The "Upper Coal" of Merryton may perhaps be the same as the seam of the same name formerly worked at Shawfield (Lanark, 18 S.E.), and to a slight extent at Pather Colliery, near Wishaw (*see* p. 119). It is almost certainly on a higher horizon than the seam referred to above as perhaps representing the "Upper Coal" of Glasgow. Very variable and local in its occurrence, it is exceedingly difficult to recognise in borings near Hamilton, although at Eddlewood a 40-inch "foul coal" is recorded 21 fathoms above the Ell at what may be the same horizon.

No representative of the musselband which lies a few feet above the Upper Coal of the Dalsarf-Shawfield area (*see* p. 119) has been yet recorded in the Hamilton district.

Avonbrae Coal Group.—At a height of 32 to 43 fms. above the Ell Coal occurs a group of strata containing some thin coal seams. From the fact that they are well exposed in the cliff opposite Avonbrae Cottages (Lanark 18 N.W.), they may conveniently be referred to as the Avonbrae Coal and Fireclay Group. Four coals occur here, varying from 9 to 16 inches in thickness, the lowest being a gas coal with a conspicuous rusty weathering. The highest of the four, a 10 to 16-inch bright coal, lies 8 fms. below Skipsey's Band. This group is known also from bores in the quarter-sheet to the west (Lanark 17 N.E.). The coals are very thin and variable, however, though in one case a thickness of 19 inches is recorded.

The group is overlain in the Avon section by a thin sandstone, and above this comes about 5 fms. of blaes and fireclay of a reddish colour, with Skipsey's Marine Band at the top.

Skipsey's Marine Band.—This thin limestone is exposed (1) on the side of the path along the east side of the Avon, 450 yds. south of Chatelherault, and (2) at the top of the tributary gully, about 350 yds. west-north-west of Avonbrae. At the former locality it is an earthy limestone, 8 in. in thickness, overlying a thin coal which rests in turn on a thick fireclay. In both cases it contains the usual assemblage of marine fossils. Its stratigraphical position in the Avon gorge is probably very nearly 50 fms. above the Ell Coal, so that, as indicated on page 67, there is a slight diminution of this interval from north to south.

Skipsey's Band is nowhere exposed within Lanark 17 N.E., and has not been recorded in any bore. Its position can be fixed, however, within comparatively narrow limits by reference to the overlying Chatelherault Sandstone (*see below*), and the underlying Avonbrae Coal Group.

Barren Measures.—This group of strata, as developed in the Hamilton area, appears to be somewhat less variable than is usually the case. It has been possible to recognise a fairly constant succession of rock groups, and to some of these we have ventured to give names derived from localities where they are typically developed. The succession is approximately as follows:—

	Fms.	Ft.	In.
Red Sandstones with some fireclays	24	0	0
Purple fireclays and clays (blaes) with red marly sandstones about	12	0	0
Red sandstones (Hamilton Sandstone Group) 12 fms. to	14	0	0
Purplish fireclays and clays (blaes) with some thin coals (Barncluith Coal Group) 10 fms. to	15	0	0
Grey to reddish sandstones and faky sandstones (Chatelherault Sandstone)	13	0	0
Lilac-coloured clays (blaes) 4 ft. to	2	2	0
Skipsey's Marine Band	0	0	8

In the gorge of the River Avon the marine band is overlain by 4 to 14 feet of lilac-coloured clays, and this in turn by a thick sandstone which is well exposed in the bed of the stream close to Chatelherault Bridge. This sandstone has accordingly been named

the Chatelherault Sandstone, and, since it can be recognised in borings throughout the Hamilton field, it is an index-horizon of some local value. It varies in thickness from about 10 to about 15 fathoms, and only locally shows the red staining characteristic of the Barren Measures. Very probably it was this sandstone that was formerly quarried south of Bog Farm, beside the Lanark road.

The next item in the succession is the Barncluith Coal and Fireclay Group. This group consists of purple-coloured fireclays and blaes associated with thin coals. It is exposed in the River Avon to the south-east of Laverock Hill and near Barncluith. Three coals, of which the thickest (and lowest) measures 12 inches, are visible here. The same group is again seen on the right bank of the Avon, below the viaduct. In the Earnock Water, above High Townhill, the Barncluith Coal Group seems to be partially exposed, and here again the thickest seam measures 12 inches.

Above the Barncluith Coal Group comes a massive red sandstone which underlies a large part of the town of Hamilton, and may therefore be fitly termed the Hamilton Sandstone. Good exposures can be seen at the old quarries where the Gas Works now stand, at Tuphall Quarries, in the lower part of the Cadzow Burn, at the top of the gorge in the River Avon just south of Barncluith, etc.

The Hamilton Sandstone is followed in upward succession by a series of variegated fireclays, blaes and marly sandstones, some 12 fms. thick, and above this in turn comes another massive red sandstone with a proved thickness of over 24 fms. This sandstone is well exposed in the old quarries on both sides of the Cadzow Burn, near Cadzow, and is the highest part of the Coal Measure sequence of which we have definite knowledge near Hamilton.

A strongly marked feature of the Barren Red Measures in the neighbourhood of Hamilton is their erosion into deep and relatively narrow gorges. This cañon type of erosion is well seen in the course of the Earnock Burn, between Earnock House and Woodfoot.

It may be added that only very occasionally is there any reddening of the strata below Skipsey's Marine Band. The Chatelherault Sandstone is locally described in borings as "grey" or "white," but above it the strata definitely assume the characteristic mottled tints.

Structural Features.—The area of Coal Measures under consideration is bounded on the south-west side by the Dechmont Fault (see p. 43), which is known at Udston as the "Universal Dyke." The deepest part of the basin lies along a belt of ground stretching from Meikle Earnock to Udston. Here the Ell Coal is usually 120 to 130 fms. deep. The whole of the Coal Measure area in Lanark 17 N.E., except for the narrow faulted strip at Dykehead, is occupied by rocks belonging to the Barren or Red Measures. The same group of rocks covers the western part of Lanark 18 N.W., as far east as a line running from Bog Colliery approximately north-westwards to the Clyde west of Ross House. East of this line the Productive Coal Measures appear at the surface, and the shallowest part of the field lies along the Clyde between Upper Carbarns and Highlees.

Around Hamilton the strata are very flat, a commonly recorded angle of dip being three degrees.

Next to the Dechmont fault the largest dislocation is one which has been termed the "Brockhill Dyke." This fault runs east and west, and follows roughly the southern boundary of the two quarter sheets. It has a downthrow to the north, which near the point where it crosses the River Avon amounts to 40 fms. Another east-and-west slip, with northerly downthrow, runs parallel to the last half-a-mile or so farther north. Its throw is smaller, however, but the fracture can be traced from beyond the Clyde as far as Meikle Earnock, passing just south of Home Farm, Allanton, Cadzow, and Neilsland Collieries. It may be designated the Eddlewood Fault.

North-westerly faults are also frequent, especially in the eastern part of the area described. One of these, with a downthrow to the north-east, crosses the River Avon between the old and the new Avon Bridges, and it is suggested that it may be called the Avon Bridge fault. Its throw at the neighbouring Ferniegair Colliery is stated to be $24\frac{1}{2}$ fathoms. A smaller member of this class near Ross House appears to end off against an east-and-west fault. In the same way a 10-fathom slip of the north-western series, slightly east of the Avon, appears to terminate on one side against the "Brockhill Dyke" and on the other side against the Eddlewood fault. These cases are probably to be explained by deflection, and are recorded on account of the evidence they furnish as to the later age of the north-westerly faults.¹

Buried Channels of Clyde and Avon.—A considerable thickness of sand and mud, which is often water-bearing, overlies the boulder-clay or rests upon solid rock over much of the ground to the east of Hamilton. Sand is present in considerable thickness at Ferniegair (see p. 133), but the tract to which we particularly refer runs parallel to the River Clyde from Ross Colliery to Upper Carbarns, and sends out a branch to the south at Merryton Colliery. These accumulations will be more fully dealt with on page 133; for the present it will be sufficient to state that they are regarded as filling old wide valleys hollowed out by the Clyde and by its tributary the Avon.

The coal seams are in the main too deeply buried to be intersected by these hollows, but a portion of the Ell Coal was worked with too thin a rock-cover beneath the base of the old Clyde valley to the north of Home Farm Colliery. The result was a disastrous subsidence of the loose material into the workings, which took place in the year 1877. The site of the subsidence is still occupied by a pond in the Clyde alluvium.

Reserves of Coal.—Here, as in so many other districts, the thick coals from the Splint upwards are very largely worked out. Little remains of the Ell, Main, and Splint, and the Pyotshaw also is exhausted over large areas. There is a good deal of Humph Coal still intact; this seam, for example, has only recently been opened out at Cadzow. There are still large reserves of Blackband Coal to be extracted, especially where, as at Barncluith, collieries were abandoned prior to the introduction of coal-cutters. The Virtuewell and the so-called Kiltongue Coals are locally too thin to work, but in both

¹ See "Geology of the Glasgow District" (*Mem. Geol. Surv.*), 1911, pp. 170 and 172.

cases there are still large areas to exploit. The remaining seams appear to be thin and unreliable, and, although one or two may be locally found to be of workable thickness, the district will be practically wrought out when those already named have been entirely removed. Upon the whole the future prospects of this district are perhaps less promising than those of the adjoining district of Wishaw.

M. M., C. H. D.

B. WISHAW DISTRICT.

Six-inch maps, Lanark, 18 N.E. ; 18 N.W. (north-east of the River Clyde).

The district to be now described covers an area of approximately nine square miles, extending from the Camp Viaduct which carries the Motherwell-Hamilton railway across the Clyde as far eastwards as a line joining Newmains and Law Junction Station. This strip of country, which includes on its north-central margin the town of Wishaw, has long been an active mining centre. The account of Cambusnethan Parish (1839), given in the "New Statistical Account of Scotland,"¹ mentions the Ell, Main and Splint seams as being worked in a shallow pit near Wishaw Distillery. These thick upper seams have been very extensively wrought, and probably very little of them remains. Coal is still obtained from all three, but the future of the district depends upon the thinner seams which underlie them. Over by far the greater part of the district the rocks that appear at the surface belong to the Productive Coal Measures, the general succession in which is shown in the two following representative sections. Reference should also be made to the graphic sections given on Plate VI, Sections 2, 3, and 4.

GENERAL SECTIONS OF PRODUCTIVE COAL MEASURES.

(1) EAST AND SOUTH-EAST OF WISHAW.

	Thickness.			Depth.		
	Fms.	Ft.	In.	Fms.	Ft.	In.
Horizon of SKIPSEY'S MARINE BAND.						
Strata estimated	28	0	0	28	0	0
"UPPER COAL" variable, up to	0	3	5	28	3	5
Strata about	25	0	0	53	3	5
ELL COAL 9 ft. to	1	5	0	55	2	5
Strata 8 fms. to	12	0	0	67	2	5
PYOTSHAW COAL	0	2	6	67	4	11
Strata an inch or two to	5	3	0	73	1	11
MAIN COAL	0	4	6	74	0	5
Strata	7	3	0	81	3	5
HUMPH COAL	0	0	6	81	3	11
Strata variable, average	5	0	0	86	3	11
SPLINT COAL	0	4	8	87	2	7
Strata 1 in. to	0	2	0	87	4	7
VIRGIN COAL 8 in. to	0	2	1	88	0	8
Strata	15	3	0	103	3	8
BLACKBAND COAL up to	0	1	2	103	4	10

¹ Vol. vi., 1845, p. 610.

Coal Measures.

		Thickness.			Depth.		
		Fms.	Ft.	In.	Fms.	Ft.	In.
Strata		9	0	0	112	4	10
VIRTUEWELL COAL	2 ft. 6 in. to	0	3	4	113	2	2
Strata		6	0	0	119	2	2
BELLSIDE IRONSTONE	very local	0	0	10	119	3	0
Strata		2	0	0	121	3	0
COAL, ? LADYGRANGE	0 in. to	0	0	7	121	3	7
Strata		10	0	0	131	3	7
KILTONGUE MUSSELBAND SHALE							
AND IRONSTONE		0	1	2	131	4	9
Strata	6 fms. to	8	0	0	139	4	9
KILTONGUE COAL	up to	0	3	6	140	2	3
Strata	5 fms. to	8	0	0	148	2	3
UPPER DRUMGRAY COAL,							
	1 ft. 4 in. to	0	1	10	148	4	1
Strata	4½ fms. to	6	0	0	154	4	1
MID DRUMGRAY COAL	up to	0	3	6	155	1	7
Strata		5	0	0	160	1	7
LOWER DRUMGRAY OF SMITHY COAL		0	1	9	160	3	4
Strata		5	0	0	165	3	4
SHOTS GAS COAL		0	0	10	165	4	2
Strata		12	3	0	178	1	2
MILL COAL		0	1	3	178	2	5
Strata	about	7	0	0	185	2	5
BALL COAL	very inconstant	0	0	7	185	3	0
Strata	about	3	0	0	188	3	0
MAIN COAL	very inconstant	0	1	0	188	4	0
Strata	about	14	3	0	203	1	0
Conjectural Base of Coal Measures.							

(2) WEST AND SOUTH-WEST OF WISHAW.

		Thickness.			Depth.		
		Fms.	Ft.	In.	Fms.	Ft.	In.
SKIPSEY'S MARINE BAND	8 in. to	0	1	0	0	1	0
Strata	about	32	0	0	32	1	0
COAL	very variable	0	1	2	32	2	2
Strata	up to	21	0	0	53	2	2
ELL COAL	up to	1	4	0	55	0	2
Strata	6 fms. 3 ft. to	11	0	0	66	0	2
PYOTSHAW COAL	2 ft. 4 in. to	0	3	4	66	3	6
Strata	a few inches to	5	3	0	72	0	6
MAIN COAL		0	4	6	72	5	0
Strata		6	3	0	79	2	0
HUMPH COAL	1 ft. 2 in. to	0	1	10	79	3	10
Strata		5	0	0	84	3	10
SPLINT COAL	.4 ft. to	0	4	10	85	2	8
Strata	3 in. to	0	0	9	85	3	5
VIRGIN COAL	7 in. to	0	1	4	85	4	9
Strata		15	0	0	100	4	9
BLACKBAND COAL	4 in. to	0	1	8	101	0	5
Strata	7 to 15 fms., average	8	3	0	109	3	5
VIRTUEWELL COAL	2 ft. to	0	3	0	110	0	5
Strata		5	3	0	115	3	5
COAL, ? LADYGRANGE	.6 in. to	0	0	10	115	4	3
Strata		6	3	0	122	1	3
KILTONGUE MUSSELBAND SHALE							
and IRONSTONE	very variable	0	1	0	122	2	3
Strata	(locally 10 fms.)	5	3	0	127	5	3
KILTONGUE COAL	variable, up to	0	2	6	128	1	9
Strata	4 fms. to	6	0	0	134	1	9
UPPER DRUMGRAY COAL		0	1	8	134	3	5

		Thickness.			Depth.		
		Fms.	Ft.	In.	Fms.	Ft.	In.
	Strata	3	0	0	137	3	5
MID DRUMGRAY COAL,							
	very variable	0	1	3	137	4	8
	Strata	3	3	0	141	1	8
LOWER DRUMGRAY COAL .	up to	0	1	7	141	3	3
	Strata	2	3	0	144	0	3
SHOTTS GAS COAL	up to	0	1	0	144	1	3
	Strata	9	0	0	153	1	3
MILL COAL		0	0	6	153	1	9
	Strata	16	0	0	169	1	9
	variable						
	Conjectural Base of Coal Measures.						

The extra thickness shown in the former section is an instance of the gradual eastward thickening (*see* p. 3) of the Productive Coal Measures. The lower part of the Barren or Red Measures is also represented in the district, while in the south-west corner of Lanark 18 N.E., there is a very small area which is possibly part of a faulted inlier of Carboniferous Limestone rocks.

The collieries at present working, and the seams being raised, are shown in the following table:—

COLLIERY.	COALS WORKED.
Herdhill	Mid Drumgray, Lower Drumgray.
Law (Pit No. 6).	Kiltongue, Lower Drumgray. ¹
Thornlie	Ell, Main, Splint.
Wishaw (Heathery Pit)	Virtuewell.
" (Berryhill Pit)	Main.
Shields	Ell, Main, Splint, Virtuewell, Upper Drumgray.
Dalzell and Broomside	Ell, Pyotshaw, Main, Splint, Blackband, Virtuewell, Kiltongue.

Armada Coal Group.—This group of coals, which includes the Crofthead, Main, Ball and Mill seams, is of little economic value in the Wishaw area. The base of the Productive Coal Measures itself can be only very approximately determined since nowhere has any definite representative of the Crofthead Slatyband Ironstone been so far recorded (*see* Sections 1 to 4, Plate VI.). The position of the Crofthead Coal in the ground east of Wishaw is very probably to be referred to a group of thin coals associated with fireclays and clayband ribs. In No. 1 bore, Lanniesmuir, situated on the Garrion Gill not far from Garrionburn Cottage, two of these coals, 12 feet apart, and about 40 fms. below the Smithy Coal, measure 12 and 13 in. respectively. It is difficult to identify their equivalents in the few other bores in the district that reach the position, and they are not likely ever to attract attention. The Armada Main Coal may be of workable thickness in the south-east corner of Lanark 18 N.E., where it appears to vary from 12 to 20 in., but the Ball Coal, separated from it by 2 or 3 fms. of fireclay, is of no value. Its position is sometimes occupied by a bed of blaes with clayband ribs lying 7 or 8 fms. under the representative of the Mill Coal. The latter seam is certainly the best developed and most persistent

¹ The Lower Drumgray of Law is the same as the Mid Drumgray of Herdhill.

of the Armadale group in the Wishaw district. As a workable subject, however, it is confined to the country east and south-east of Wishaw, where it perhaps averages 15 inches in thickness and may reach 20 inches. From its development in the adjoining Castlehill field, where it has recently been sunk to, the most likely area for exploitation would be that around Law Junction Station. West of Overton village it is nowhere known to be of value; a bore near Cambusnethan House records a 7-inch coal lying 8 fms. below the Shotts Gas, and in the deep bore at Wishaw Quarry (Plate VI., Section 3) the thickness is still less.

Shotts Gas Coal.—There are few available records of this seam, but it certainly has little economic value within the area considered. At Morningside it varies from 8 to 16 inches, averaging perhaps $13\frac{1}{2}$; and at Castlehill, though it locally reaches 20 inches, it is not considered workable. Around Herdshill and Lawmuir it appears to average 13 or 14 inches, varying from 9 to 22 inches. It is thin both at Wishaw and near Cambusnethan. In 18 N.W. it is nowhere known to exceed a foot, and is generally considerably less. "Mussels" have been recorded from the roof of this seam at Overton, and are known to occur at the same horizon at Shotts and elsewhere. The occurrence of these "mussels" is one of the reasons for correlating this seam with the Watstone Musselband Ironstone of Stonehouse.¹

The strata between the Shotts Gas and the Lower Drumgray (or Smithy) Coal amount to some 5 fathoms in the eastern part of the district here described. At Wishaw, near Cambusnethan House, and in Lanark 18 N.W. (so far as is known), the distance is only 2 to 3 fathoms.

Lower Drumgray (Smithy) Coal.—Two different seams are worked in the ground east and south-east of Wishaw under the name of Lower Drumgray. This title is reserved in these pages for the coal which occupies the position of the Smithy Coal of the Shotts field, and is almost certainly the genuine Lower Drumgray of the district to the north. It is wrought at Chapel (Lan. 19 N.W.), Castlehill, and Waterlands (Lan. 19 S.W.), just east of the area under description, but within the limits of Lanark 18 N.E., it has been mined only at Herdshill Colliery (since 1911) and to a small extent at the abandoned colliery at Gillhead. It varies at these localities from $1\frac{1}{2}$ to 2 feet in thickness; the roof is very often of sandstone, but locally 2 to 18 inches of blaes immediately overlie the coal; the floor is of fireclay or fireclay fakes.

At Wishaw the Smithy Coal is recorded in a boring² as 21 inches, and the same seam at Shields Colliery shaft is given as 19 inches thick. Two old bores, near Cambusnethan House, record thicknesses of only 11 and 15 inches respectively.

There is, therefore, a considerable area east and south-east of Wishaw where the Smithy Coal may yet be exploited. Over most of the Wishaw area indeed it would seem to be a workable subject,

¹ See "Econ. Geol. Central Coalfield, Area VIII." (*Mem. Geol. Surv.*), 1917, p. 40; also "Area IX." (in preparation).

² See Plate VI., Section 3.

between 18 and 24 inches in thickness, but it thins to the west and south-west. The most promising field would seem to be the southern portion of Lanark 18 N.E., around Waterloo, Overton, and Lawmuir.

The strata between the Smithy Coal and the next highest seam, the Mid Drumgray, amount to about 5 fathoms at Herdshill and Lawmuir and consist of fakes and sandstones with some posts of kingle. Westwards, the distance is only 3 or 4 fathoms at Wishaw, Cambusnethan House, and Shields Colliery.

Mid Drumgray Coal.—The Mid Drumgray of the Coltness Iron Company's pits at Herdshill (Lanark 18 N.E.) and Garriongill (Lanark 18 S.E.) corresponds to the so-called Lower Drumgray of Chapel (Lanark 19 N.W.), Law (Lanark 18 N.E.), and Shawfield (Lanark 18 S.E.). At Castlehill (Lanark 19 S.W.) it is known as the 4-foot coal, and at Shotts is termed the Low or Laigh seam. It is much less persistent than either the Smithy or Upper Drumgray, but locally it reaches a thickness never attained in this area by either of these coals. A characteristic of the Mid Drumgray is its very common occurrence in two leaves separated by a fireclay parting of variable thickness. It is at present wrought at two collieries on the eastern margin of Lanark 18 N.E. For a number of years it has been raised along with its underlying fireclay at Herdshill, and has recently been opened out at No. 6 Pit, Law Colliery, about half a mile west of Law Junction Station. It was formerly raised from the abandoned No. 2 Law Pit a little north-east of the station. Throughout the area which includes these localities the Mid Drumgray averages perhaps 3 ft. 6 in., a typical section showing:—

		Ft.	In.
Sandstone			
Blaes	0 up to	3	0
COAL		2	4
Fireclay	$\frac{1}{2}$ to	0	2
COAL		1	1
FIRECLAY	up to	3	0

The coal is generally described as a first-class house coal, but is also used for steam-raising purposes. The fireclay underseat is wrought both at Chapel and Herdshill. As found at Chapel it is a grey, rooty, and fairly hard material with physical properties which make it specially valuable for the manufacture of the variously-shaped bricks and blocks used in the construction of furnaces, oil retorts, cement kilns, etc. The clay from Herdshill is employed at the Coltness Company's works at Newmains in the manufacture of various kinds of enamelled ware.

Its deterioration to the west may be illustrated by the fact that in two bores near Cambusnethan House it measures 16 $\frac{1}{2}$ and 20 inches respectively. In the deep bore at Wishaw Quarry (Plate VI., Section 3) the possible equivalent of the Mid Drumgray measures 17 inches, and at Shields Colliery Shaft we find, in the same position:—

	Ft.	In.
COAL, top 4 in. "bad"	0	7
Fireclay	1	6
Faky sandstone	2	9
COAL	0	8
Fireclay	3	0

The strata between the Mid and Upper Drumgray Coals consist mainly of fakes and sandstone. At Harestonhills, Herdshill, and Lawmuir they amount to between $5\frac{1}{2}$ and 7 fms., at Wishaw to about $4\frac{1}{2}$ fms., and farther west in Lanark 18 N.W., may be only 3 fms. in thickness.

Upper Drumgray Coal.—This coal is reported to be 20 inches thick in the shaft section of Herdshill Colliery. In borings on Harestonhills, Herdshill, and Lawmuir it varies from 15 to 22 inches, a fairly characteristic section being:—

		Ft.	In.
Blaes and balls	about	2	0
Shaly blaes	6 in. to	0	8
COAL		1	8
Faky fireclay		1	6

In No. 14 bore, Harestonhills, situated 500 ft. east of Harestonhills Farm, and again in a boring near Eastmuir Quarry on the north edge of Greenhead Moss, the sections recorded are:—

HARESTONHILLS.				GREENHEAD MOSS.			
	Ft.	In.			Ft.	In.	
Blaes and balls	2	0		Fireclay and balls	3	6	
Black blaes	0	8		Dark blaes	0	3	
COAL	1	10		COAL	1	9	
Fireclay	1	6		Fireclay	0	2	

In the deep boring at Wishaw Quarry (Plate VI., Section 3) the Upper Drumgray would seem to be poorly represented, and in a bore near Cambusnethan House it is recorded as only $11\frac{1}{2}$ inches of coal underlying $9\frac{1}{2}$ inches of coaly blaes. The shaft section of Shields Colliery shows the following section in the Upper Drumgray position:—

	Ft.	In.
Blaes and ironstone ribs	0	$11\frac{1}{2}$
COAL	2	3
Fireclay		

The seam was recently opened out to a very small extent at No. 9 Pit, Shields Colliery, and proved to be 21 to 25 inches in thickness. A bore "on Carbarns" records 19 inches of coal in the Upper Drumgray position, and the seam at Dalzell is about 22 inches in thickness.

The Upper Drumgray is thus fairly constant, although thin, over much of the Wishaw area.

The strata intervening between the Upper Drumgray and Kiltongue Coals average 5 or 6 fms. in thickness, locally in the Harestonhills area reaching as much as $8\frac{1}{2}$ fms. A thin coal a few inches in thickness sometimes occurs towards the middle of this interval.

Kiltongue Coal.—The Kiltongue Coal is of little value in the Shotts district, but becomes of economic importance along the eastern edge of the Wishaw coalfield. It varies from 18 to 31 inches at Chapel Colliery, where the underlying fireclay is also worked to some extent, and is about 3 feet thick at Castlehill. In the south-east corner of Lanark 18 N.E., this seam was formerly raised at No. 2 Pit, Law Colliery, and at Herdshill (up to 1910). It is now being

worked at the recently-sunk No. 6 Pit, Law Colliery, half a mile west of Law Junction Station. In this part of the Wishaw field the Kiltongue Coal is about $3\frac{1}{2}$ feet thick, and a typical section shows:—

		Ft.	In.
Sandstone roof			
Blaes or faky blaes	variable	0	8
COAL		2	10
Parting	1 in. to	0	4
COAL		0	6
Fireclay			

A partial section of the seam is exposed in the Garrion Burn,¹ a little west of south from Garrionburn Cottage, where at least 2 ft. 8 in. of coal could recently be seen. South-west of this again, in Lanark, 18 S.E., the Kiltongue is worked at Shawfield and Garriongill Collieries and at the latter shows:—

		Ft.	In.
COAL	2 ft. 3 in. to	2	6
Fireclay	up to	9	0
COAL	8 in. to	1	0

The parting therefore appears to increase in thickness towards the south, leading to a division of the seam into two leaves known as the Upper and Under Kiltongue respectively (Larkhall district).

As a workable subject the Kiltongue Coal appears to underlie the whole of the eastern half of Lanark 18 N.E. A bore on the north edge of Greenhead Moss, for example, records a thickness of 27 inches. Farther west, however, its development is not so good, as bores at Wishaw give thicknesses of only 13, 18, and 20 inches, while at Cambusnethan House we find an old bore recording as little as $9\frac{1}{2}$ inches at what is probably this horizon. It seems to be poor also at Shields Colliery, but has been wrought at Dalzell and Broomside for a number of years, and is of workable thickness in a boring at Carbarns. The three sections are as follows:—

SHIELDS COLLIERY SHAFT.				DALZELL.			
	Fms.	Ft.	In.		Fms.	Ft.	In.
Sandstone	6	2	0	Sandstone	15	0	0
Shale and ironstone	0	1	4	COAL	0	2	4
Shale	0	0	9	Parting	0	1	1
COAL	0	0	4	COAL	0	0	8
Fireclay	0	0	10				
COAL	0	0	10				
Fireclay	0	0	9				

CARBARNS BORE.			
	Fms.	Ft.	In.
Sandstone	11	2	3
COAL	0	2	3
Fireclay	1	0	6

The Kiltongue Coal is a uniform seam of bright, clean coal, producing a household fuel of excellent quality. It does not appear to

¹ M. Macgregor. "The Garrion Gill Section at Overton, near Wishaw." *Trans. Geol. Soc. Glasgow*, vol. xiv., 1911, p. 279.

have been worked anywhere between Herdshill in the east and Dalzell in the west. There is thus a large area which may reasonably be considered as reserve, and this coal is perhaps the most promising in regard to the future development of the ground which has yet been considered.

The strata between the Kiltongue Coal and Kiltongue Musselband vary from 5 fms. near Wishaw to an average of about 10 fms. in the district which includes Shields, Carbarns, and Dalzell Collieries. The latter figure is due to the intervention of a thick post of sandstone.

The Kiltongue Musselband Shale and Ironstone is well exposed at several points along the Garrion Burn, the most easterly being in the neighbourhood of Gillhead Bridge. An average section is:—

	Ft.	In.
Thick sandstone		
Dark shaly blaes	1	5
CANNEL SHALE	0	6
MUSSELBAND SHALE	0	8½
CLAYBAND IRONSTONE	0	2
Fireclay or blaes with small clay ironstone balls	3	6
Fakes and sandstone		

The cannel shale is tough in texture and has a dull lustre; it contains fish scales and teeth, entomostraca, and calamite stems. It has a brownish streak, "curls" readily under the knife, and, though difficult to kindle, burns with a bright flame. The underlying musselband is a reddish-weathering shale crowded with *Carbonicola* shells. Borings in the neighbourhood of Lanniesmuir, Herdshill, and Harestonhills give a somewhat similar section.

At a variable distance above the Musselband occurs a thin coal which may quite well correspond to the *Ladygrange Coal* of Longriggend and Slamannan. In the western part of the district this varies from 10 to 12 inches in thickness; in the eastern part it consists of about 6 inches of parrot coal overlying a thin rib of clayband ironstone.

Bellside Ironstone.—This thin seam of blackband ironstone was wrought to a slight extent near Wishaw and from an old pit on the west side of Branchal Road at Cambusnethan, where it was only 4½ or 5 inches thick. Bores near Wishaw record thicknesses of 7 to 10 inches, but there is no bore in any other part of the field showing as much as this.

The distance between the Kiltongue Musselband and the Virtuewell Coal decreases from east to west in the Wishaw district. At Harestonhills and Lawmuir it is about 19 fathoms; at Dalzell Collieries only some 10½ fathoms.

Virtuewell Coal.—This coal is wrought at Wishaw (Heathery Pit), at Shields, and at Dalzell and Broomside Collieries. It has also been worked to a considerable extent along the eastern edge of Lanark 18 N.E. In the Stonecraigs field, on the north and downthrow side of the Herdshill-Harestonhill fault (*see* p 122), it has been worked out between No. 4 Pit and Newmains House. To the south of the fault the Virtuewell is the highest seam that occurs in the Herdshill district. It is well exposed in the Garrion Burn

immediately opposite the Caledonian Railway Company's pumping station. The sections of the seam at Stonecraigs and Herdshill may be given here:—

STONECRAIGS.		HERDSHILL.	
	Ft. In.		Ft. In.
Faky blaes	5 8	Faky blaes	variable
SHALE	0 4	SHALE	2 in. to 0 5
COAL	2 6½	COAL	up to 3 1
Fireclay	1 3	Fireclay	1 4

The section in the Garrion is as follows:—

	Ft. In.	
SHALE	at least 0 3	
HARD COAL	2 1	} COAL, 3 ft. 11½ in.
SOFT COAL	0 9	
HARD COAL	1 1½	

The little rib of parrotty blaes or shale is a very characteristic feature of the Virtuewell Coal, not only here but in other parts of the Lanarkshire basin. A small area of this coal was recently worked at No. 6 Pit, Law Colliery, where it averaged some 40 inches.

West of the localities mentioned the Virtuewell has nowhere been worked until we reach Wishaw. At the Heathery Coal Pit, where the seam was opened out in 1911, it shows approximately:—

	Ft. In.
Fireclay and balls	4 6
COAL	2 3
Fireclay	0 5

Between this pit and Stonecraigs few records are available. A bore on Greenhead Moss gives a thickness of 22 inches; two bores at Wishaw record only 17 and 18 inches, and two on Pather to the south of Wishaw show the Virtuewell as 10½ and 23 inches respectively.

At Shields and Parkhead Collieries (the latter lies on the south margin of Lanark 12 S.W.) the Virtuewell shows:—

SHIELDS.		PARKHEAD.	
	Ft. In.		Ft. In.
SANDY IRONSTONE	2 0	IRONSTONE BALLS	1 5
"Bonnetts" ¹	1 4	Fireclay and balls	1 1
COAL	2 10	Faky fireclay	1 0
Fireclay pavement		COAL	2 10
		Fireclay pavement	

and in a bore at Shieldmuir we find:—

	Ft. In.
IRONSTONE	0 8
Fireclay	1 5
Black blaes	0 1½
COAL	2 0

¹ See Glossary, p. 135. The "bonnetts" were not in this case worked with the coal seam.

In the ground around Dalzell and Broomside Colliery, and westwards towards Camp Viaduct, the Virtuewell is from 35 to 38 inches thick. A bore from the Splint Coal in No. 1 Pit, Camp Colliery, found 25 inches of coal in this position.

The seam appears to be intact to the south-east of Shields Colliery and Dalzell House, and over a large area south and south-east of Wishaw. We have little information regarding its thickness in this part of the field. It is probably rather less than in the worked areas to west and east, but no doubt forms an important reserve which in time will be largely drawn upon. There is some evidence of an area of "thin coal" between Overton Village and Carbarns.

Roughband Ironstone.—This horizon is of little value in the Wishaw district. The sections already given of the Virtuewell Coal at Shieldmuir, Shields, and Parkhead may be referred to. In one bore at Wishaw an 8-inch clayband rib is recorded lying 5 feet above the Virtuewell Coal, but in other borings there is no mention of ironstone at this horizon. When traced south-eastwards the intervening strata appear to thicken. A bore near Lanniesmuir records 9 inches of clayband about 4 fathoms above the coal, and another on Harestonhills shows 12 inches of clayband in the same position.

The strata between the Virtuewell Coal and the next highest seam—the Blackband Coal—consist mainly of sandstone and fakes. The distance is between 8 and 9 fms. on an average, but increases locally to 10 fms., and at Shields Colliery is 16 fms. This increase is due to the development of a thick sandstone in the position of the Auchinlea Sandstone of the Cleland-Newarthill district (*see* page 77). It is best developed at Shields Colliery where the shaft section records a thickness of approximately 11 fms.

Blackband Coal.—The Blackband Coal is at present raised within the Wishaw district only at Dalzell and Broomside Colliery. The workings in this seam from Parkhead Colliery (Lanark 12 S.W.) extend for some distance into Lanark 18 N.W. The following sections will illustrate its development over this area:—

DALZELL COLLIERY.				PARKHEAD COLLIERY.			
		Ft.	In.			Ft.	In.
				Fakes		1	2
				Blaes and balls		1	7
				Black blaes		0	3
COAL	.	0	9	COAL	.	1	0
Fireclay	.	0	9	Coaly blaes	.	0	5
COAL	.	0	2	COAL	.	0	3
Fireclay	.	0	2	Slit	.	0	2
COAL	.	1	2	COAL	.	1	2

NO. 1 PIT CAMP COLLIERY (BORE).

	Ft.	In.
Faky blaes and Ironstone ribs	3	7
Blaes and Ironstone ribs	0	9
COAL	0	11
Blaes	0	4½
COAL	0	2½
Blaes	0	2
COAL	1	4

There is very little evidence regarding the thickness of the Blackband Coal south-east of these localities. There are two bores near Carbars passing through the position, but the exact sites of these are unknown; one records 12 inches of coal lying $16\frac{1}{2}$ fms. below the Splint, the other records 2 inches of blackband above 4 inches of coal about 16 fms. below the Splint. At the same time it should be pointed out that south of the Clyde, at Bog, Merryton, etc., the Blackband Coal is of workable thickness.

It is very doubtful if it will be found workable at any locality farther east. At Shields Colliery it seems to be represented in the shaft section by a 4-inch coal. At Wishaw 4 bores record thicknesses of 10, $10\frac{1}{2}$, 12, and 13 inches. A bore on Greenhead Moss gives 14 inches, and in another at Gillhead a 22-inch seam is recorded $11\frac{1}{2}$ fms. above the Virtuewell. In the Garrion Barn again a 16-inch coal with a slaty rib seems to represent the Blackband horizon. Probably a fair average thickness for the Wishaw district would be 12 inches.

Musselband Coal.—Seven or eight fathoms above the Blackband Coal there is very constantly a thin seam in the position of the Musselband Coal of Greengairs and other districts of Lanarkshire. It has no value in this field where it varies, when present, from 5 to 9 inches in thickness. Only along the southern edge of the district in the neighbourhood of Overton does it appear to exceed these limits, and between this locality and Garriongill Colliery (Lanark 18 S.E.) it may reach as much as 15 inches. In the Garrion Burn section it is apparently represented by a 6-inch coal overlain by 3 fms. of blaes and ironstone ribs at the top of which a few "mussels" have been found.

Eight or nine fathoms higher in the sequence comes the lowest of the thick upper seams, the Splint Coal. This coal, like the Main, Pyotshaw, and Ell, has been for a long time extensively worked. It may be remarked that these seams are rapidly approaching exhaustion. There still remain areas left unworked for one reason or another by the old miners, and the stoops in some of the abandoned workings have of late years been removed. In the case of the Ell Coal again a large amount of coal must have been lost through the practice of leaving intact the top 3 or 4 feet of that seam in order to serve as a roof, the strata above the coal itself consisting typically of soft blaes.

Splint and Virgin Coals.—The Virgin or Sourmilk Coal in the Wishaw field forms practically one seam with the Splint, and the two will accordingly be dealt with together. The Splint Coal was formerly extensively worked, but no particular attention was paid to economy in working, and over large areas stoops of considerable size were left standing. There is probably also a considerable amount of coal in areas left as barriers or supports, or abandoned because more troublesome than usual to mine, but the coal in question must to a large extent be regarded as lost. Coal has been raised from the Splint seam at Thornlie (Wishaw) for a number of years in an area which had been long ago abandoned. The seam was wrought at Wishaw and Cambusnethan Collieries up to 1909–10, and farther west is still mined at Shields and Dalzell.

In the old Stonecraigs No. 4 Pit, to the south of Coltness Iron Works, the Splint Coal showed:—

	Ft.	In.
Blaes and balls		
FREE COAL	0	10
FREE and SPLINT COAL	1	1
SPLINT COAL	0	6
FREE COAL	0	8
PARROT COAL	0	3
FREE COAL	1	4
Slate	0	6
FREE COAL (VIRGIN SEAM)	2	1

In the Waterloo, Overton, Overton Station, and Garriiongill workings the combined seams were 4 to 6 feet in thickness. Two detailed sections may be quoted, one at Overton and one at Wishaw:—

OVERTON COLLIERY.				WISHAW.			
	Ft.	In.			Ft.	In.	
Blaes			Blaes				
SPLINT and FREE COAL	2	1	FREE COAL		0	11	
PARROT COAL	0	3	SPLINT COAL		1	6	
FREE COAL	0	10	GAS COAL	2 in. to	0	6	
Slit	0	1	FREE COAL	6 in. to	0	10	
FREE COAL (Virgin)	0	11	Stone	3 in. to	2	0	
			FREE COAL	8 in. to	1	2	

At Thornlie the section is:—

	Ft.	In.
COAL	4	6
Slit	0	5
COAL (VIRGIN)	0	10

At Cambusnethan Colliery the seam showed a thickness of 4 to 4½ feet, with a 5 to 10-inch rib of gas coal. The Splint Coal was extensively wrought west and south-west of Wishaw at Shieldmuir, Muirhouse, Clydesdale, and Carbars Collieries, and is still worked at Shields and at Dalzell. Four sections are given below:—

SHIELDS.				SHIELDMUIR.				CARBARS.				DALZELL.			
	Ft.	In.		Ft.	In.			Ft.	In.	Ft.	In.	Ft.	In.		
FREE COAL	0	10		0	6										
SPLINT COAL	1	8		1	6	SPLINT COAL	2	6	2	9					
FREE COAL	0	6		0	5	GAS COAL	1	6	1	8					
GAS COAL	1	10		1	8	Parting	0	4	0	3					
Parting	0	4		?		FREE COAL	1	4	1	2					
FREE COAL	0	9		?											

The lowest leaf of coal in these sections represents the Virgin seam. The constituents enumerated vary much in thickness. The rib of gas coal may be considerably less than is recorded in the sections given, while locally the Virgin Coal reaches as much as 21 inches.

The strata between the Splint and Main Coals have an average thickness of 12 to 13 fms., and consist mainly of fakes and faky sandstones. Towards the middle of this interval, but rather nearer to the Splint than to the Main, occurs a very variable seam known as the Humph Coal. This has been wrought from Parkhead Colliery

(Lanark 12 S.W.) over a small area to the west of the Fir Park Plantation on the north margin of Lanark 18 N.W., where it varied from 18 to 22 inches in thickness. An average section showed:—

	Ft.	In.
Blaes and balls	3	6
Blaes, falling	0	5
COAL	1	8
Daugh	0	4

Nowhere else within the area dealt with has it been worked. Its thickness at various localities in 18 N.W. is shown in the following table:—

	Ft.	In.
Dalzell Shaft	1	6
Lady Emily Pit	1	5
Shields Colliery	1	2
Bore on Baron's Haugh	1	8
Carbarns Colliery	1	2

It is not represented at all in two bores at Shieldmuir, and farther east, within Lanark 18 N.E., is very poorly developed. In one bore at Wishaw it is recorded as 14 inches thick, but elsewhere within the sheet has no economic value. Bores near Greenhead and Gillhead give thicknesses of 9 and 6 inches, while in the Garrion Burn section the Humph Coal is represented by a 2-inch seam.

Main and Pyotshaw Coals.—The distance between these seams varies from an inch or two up to seven fathoms. They are thus more conveniently dealt with together. At Stonecraigs the section in the old workings showed:—

	Ft.	In.
PYOTSHAW COAL 2 ft. 9 in. to	3	0
Fireclay 4 in. to	2	6
MAIN COAL 3 ft. 10 in. to	4	4

In the Overton-Garriongill area the combined seam showed:—

	Ft.	In.
PYOTSHAW COAL 1 ft. 8 in. to	2	6
Fakes or blaes 6 in. to	5	0
MAIN COAL { COAL 2 ft. 5 in. to	2	8
{ Sclit or daugh	0	2
{ COAL	1	8

The division between the seams thickened here to the south and at Castlehill Pit and again in the natural section exposed in the Garrion Burn we find:—

PYOTSHAW COAL	about 1 ft. 2 in.
Strata	4 to 5½ fms.
MAIN COAL	about 4 ft. 7 in.

The detailed section of the Main Coal as worked at Castlehill showed:—

	Ft.	In.
FREE COAL	1	1½
SPLINT COAL	0	3
FREE COAL	1	0½
Slate (? sclit)	0	4½
FREE COAL	0	10
SPLINT COAL	0	6½
FREE COAL	0	5

The parting of slaty coal, or daugh, which divides the seam into two approximately equal parts, is characteristic of the seam in the Wishaw district.

The stoops in the abandoned workings at Overton and at Waterloo have been removed of late years. They were wrought at Overton as late as 1911-12 and at Waterloo up to 1914. The average section here was :—

			Ft.	In.
PYOTSHAW COAL	.		2	5
Parting	.		9	0
	(	COAL	0	3
		SPLINT COAL ("pugs")	1	0
MAIN COAL		COAL	0	10
		Dirt	0	3
		COAL	2	6

Two sections at Wishaw may also be recorded.

SUNNYSIDE.			QUARRY PARK.		
		Ft. In.			Ft. In.
PYOTSHAW COAL	16 in. to	3 3	PYOTSHAW COAL	.	2 1
Stone	3 in. to	1 8	Dirt	.	0 1
MAIN COAL (with parting)		4 4	COAL	.	2 6
			Dirt.	.	0 3
			COAL	. . . 10 in. to	1 8

At the latter locality (to the north of Wishaw), the coal was worked by mines on the edge of Templehall Plantation. The roof was formed by a post of sandstone quarried to some considerable extent for building purposes. This sandstone is at least 40 feet thick and is split by faky ribs into lenticular posts of freestone. It is a medium-grained yellowish rock, with brown limonite spots and (in places) kingle nodules. Sandstone also forms the roof of the seam at Sunnyside except in part of the workings of No. 6 Pit, where the course of a preglacial stream was struck, along which the roof was of sand.

To the south of Wishaw the Main Coal is still wrought at Thornlie. At the abandoned Green Colliery it showed :—

			Ft.	In.
PYOTSHAW COAL	.	.	2	2
Rib	.	.	0	6
	(	FREE COAL	2	4
		Sclit.	0	3
MAIN COAL		FREE COAL	0	7
		SPLINT COAL	0	11
		FREE COAL	0	2

At Cambusnethan Colliery the Pyotshaw was approximately 2 ft. 8 in., the Main 4 ft., while the parting between them was some 11 inches in thickness. South and south-east of this again the parting thickens (*see* Castlehill section above).

It is in Lanark 18 N.W., that the greatest variations occur. Along the eastern edge of the sheet we find :—

CLYDESDALE COLLIERY.			SHIELDMUIR COLLIERY.		
		Ft. In.			Ft. In.
PYOTSHAW COAL	.	2 9	PYOTSHAW COAL	.	2 3
Parting (sandstone)	.	2 3	Fireclay	.	1 4
MAIN COAL	.	4 3	MAIN COAL	.	4 2

while the Main Coal is made up as follows:—

	Ft.	In.
FREE COAL	1	3
SPLINT COAL	0	3
FREE COAL 9 in. or	0	10
Split or daugh	0	1½
FREE COAL	0	10
SPLINT COAL 5 in to	0	7
FREE COAL 5 in. or	0	6

Farther west at the old Lady Emily Pit, and at Shields Colliery, the distance between the seams has increased to 5½ fathoms. Here and at Parkhead the Main Coal averages 4½ feet while the Pyotshaw shows:—

SHIELDS.	LADY EMILY PIT.	PARKHEAD.
COAL . . . 6 to 9 in.	COAL . . . 10½ in.	COAL . . . 10 in.
Dirt . . . 4 to 6 in.	Dirt . . . 2 in.	Dirt . . . 1 in.
COAL . . . 23 to 29 in.	COAL . . . 22 in.	COAL . . . 20 in.
Dirt . . . 2 in.		
COAL . . . 7 or 8 in.		

The strata between the Main and Ell Coal seams average some 11 or 12 fathoms in thickness. The excellent section of these beds seen in the Garrion Burn shows one or two features of interest. About 7 fathoms below the Ell Coal, and not far above the Pyotshaw, occurs a 7-inch rib of shaly blaes containing "mussels." This horizon no doubt represents the "Cambuslang Marble" of Rutherglen and Cambuslang (*see* p. 36), but the "mussels" are few and badly preserved and have not been recorded in bores in this district. Close above this band occurs a rich plant-bed, from which 11 or 12 species of Coal Measure plants have been obtained. These strata are also marked by the presence of two or three thin beds of white trap.

Ell Coal.—Coal is still raised from this seam in the Wishaw district at Thornlie Colliery. The workings at Berryhill (Wishaw Colliery) have recently been suspended on account of fire breaking out in the blaes roof. The Ell was wrought at Overton and Waterloo up to 1912-13, and the Moss Pit workings at Woodhall, Cambusnethan, were abandoned in 1914. Much of the coal obtained at these localities in recent years came from the stoops of older workings.

The Ell Coal must be regarded as practically exhausted in the Wishaw field, though possibly untouched areas exist locally in places where it was considered difficult to work. The very constant practice of leaving the top three or four feet as a roof has also led to a regrettable waste.

A few sections of the seam in old workings may here be placed on record. At Stonecraigs and at the recently abandoned Moss Pit the seam showed:—

STONECRAIGS.	Ft.	In.	MOSS PIT.	Ft.	In.
Blaes			Blaes		
COAL, roof	4	3	COAL, roof	4	1
COAL . . . 2 ft. to	2	4	COAL	2	1
SPLINT COAL . . 4 in. to	0	7	SPLINT COAL	0	9
COAL	4	0	COAL	3	3
Daugh			Fireclay		

The roof coal was also known as "head coal," and in some workings (*e.g.* Greenhead) the lower 2 feet or so was got in stooping. Sometimes a two-inch rib of slate separated the head coal from the "breast coal," as the worked part was termed. In the Waterloo-Overton district the Ell Coal showed:—

		Ft.	In.
Blaes	up to	20	0
COAL, roof (HEAD COAL)	2 ft. to	4	0
COAL (BREAST COAL)	5 ft. to	6	0
Fireclay			

while the detailed section of the "breast coal" at Castlehill showed:—

		Ft.	In.
FREE COAL		2	0½
SPLINT COAL		1	4
FREE and SPLINT COAL		1	2½
FREE COAL		1	2

In the Wishaw neighbourhood the Ell Coal averaged 7½ to 9 feet. At Thornlie and Wishaw Collieries it shows approximately:—

		Ft.	In.
Inferior (brassy) COAL	1 ft. 3 in. to	1	6
HEAD COAL	2 ft. to	2	4
Parting		0	1
COAL (BREAST COAL)	4½ ft. to	6	0
Fireclay			

It may be noted that in the workings of the Ell at Sunnyside No. 6 Pit (now the Heathery Pit of Wishaw Collieries) the seam was found to outcrop along the sides of a sand-filled preglacial channel (*see* account of Main Coal, and also p. 122).

This seam was formerly extensively raised at Cambusnethan, Clydesdale, Muirhouse, Shieldmuir and Carbars Pits. The recorded section of the Cambusnethan workings shows:—

		Ft.	In.
"BURNT" COAL		1	6
COAL	(30 to 55 in)	3	0
"BURNT" COAL	4 in. to	0	9

The lower 2 feet at Clydesdale is also described as "burnt" (*see* note on p. 120), while at Carbars the "breast coal" worked averaged 6 feet and was overlain by 3 feet of "head coal." The seam is still wrought at Shields and Dalzell Collieries where the section is very similar to that at Carbars. Locally at Dalzell the "breast coal" shows:—

		Ft.	In.
GOOD COAL		2	8
Parting		0	1
GOOD COAL		1	0
"BURNT" COAL		0	9

For further information regarding the "burnt" coals of Dalzell and adjoining fields the reader is referred to the notes on page 120.

Strata between Ell Coal and Skipsey's Marine Band.—Skipsey's Marine Band, which is taken as the top of the Productive Coal Measures, is exposed on the north bank of the Clyde 70 yards or so

below the Camp Railway Viaduct. Its height above the Ell Coal is here about 53 fathoms. Unfortunately the horizon of Skipsey's Marine Band is not known in the neighbourhood of Wishaw, so that only a very conjectural line can here be assigned as an upper limit to the Productive Coal Measures. In Lanark 18 N.E., this difficulty arises only in a narrow area running north-westwards through Overton, Castlehill, and Netherton House. The section exposed in the Garrion includes beds as high as 51 fathoms above the Ell Coal, but no equivalent of Skipsey's Band has been detected. This section shows:—

	Fms.	Ft.	In.
COAL ("mussels" above)	0	0	8
Strata	2	0	0
COAL ("mussels" above)	0	0	8½
Strata . . . approximately	6	0	0
MUSSEL IRONSTONE, very limy ¹	0	0	8
Strata	1	3	0
COAL . . . variable, up to	0	3	5
Strata	4	3	0
COAL, very foul	0	1	1
Strata	20	0	0
ELL COAL			

With regard to this section it may be noted that the 3 ft. 5 in. coal is the same as that once wrought to the south-east at Shawfield (Lanark 18 S.E.) as the Upper Coal. It was no doubt also this seam which was worked to a very small extent under the same name at Pather No. 1 Pit, where it lay 25 fathoms above the Ell, and showed:—

	Ft.	In.
COAL	1	3
Fireclay	0	7
COAL	0	10
Fireclay	0	2
COAL	0	4½

It appears to be a very variable seam and is sometimes only 8 inches thick. A bore a little south-west of Overton and only a short distance west of the exposure in the Garrion records:—

	Ft.	In.
COAL	1	9
Blaes	0	3
COAL	1	10

There may therefore possibly be an area between Pather and the Garrion Burn, just to the north of Overton, where the coal is workable, but even this is doubtful on account of the dirty coal or blaes partings. The detailed section of the seam as exposed in the Garrion at Castlehill Orchard is:—

	Ft.	In.
COAL	1	5½
Dirty COAL	0	3
Hard COAL	1	1½
Dirty COAL	0	2
Hard COAL	0	5½

¹ Also found at Auldton and Cornsilloch in Lanark 18 S.E.

It is not easy to recognise the equivalent of this seam in other parts of the Wishaw field. A bore on Greenhead Moss records two coals lying 21 and 28 fms. respectively above the Ell; the lower seam is 15 inches thick, the upper 12 inches. Farther east again we find a coal exposed in the cutting on the Morningside to Cleland Branch Railway, just south-east of Coltness Iron Works. This section shows:—

						Ft.	In.
COAL	.	.	.	.	.	2	0
Fireclay	.	.	.	.	.	0	9½
COAL	.	.	.	.	.	2	9
Fireclay	.	.	.	.	.		

The height of this seam above the Ell is not very accurately known, but it very likely represents the Upper Coal of Shawfield and Pather. Unfortunately there is no area worth exploiting here as the seam is very soon thrown out by faulting.

West of Overton and Pather again the so-called Upper Coal appears to be thin and variable. A bore on Cambusnethan estate, not far from Castlehill, shows it to be only 13 inches thick. At Shieldmuir, Kirkhill, and Lower Carbars there occurs, about 21 fms. above the Ell, a coal averaging some 13 to 15 inches in thickness which we tentatively correlate with the "Upper" of Pather Colliery. In regard to the use of the designation "Upper Coal," it is far from certain that the seam here described represents the true Upper of Glasgow, but it may be the same as the Upper Coal of Merryton (*see* page 99).

Skipsey's Marine Band.—This thin limestone outcrops on the north bank of the Clyde about 70 yds. below the Camp railway viaduct. Here, as in the exposures already described (page 66), it is a dark grey limestone about a foot thick, breaking into big slabs, and with a tendency to form a projecting ledge on a weathered face. It overlies a 4-inch coal, which rests in turn on a 6-foot fireclay, and the height above the Ell Coal is about 53 fms.

Calcareous "burning" of Coals.—Quite apart from instances of genuine burning there occur, in various parts of Lanarkshire, areas of what is somewhat loosely termed "burnt coal." The "burning," which may affect the whole or part of a seam, has nothing to do with igneous intrusions and ought not to be described as comparable with the effects of these. It consists in the introduction of mineral matter, chiefly carbonates of lime, magnesia, and iron, into the coal to such an extent as to render it locally quite unworkable. Instances of this phenomenon have already been given in preceding pages¹ and a notable example occurs at Dalzell and Broomside Colliery within the area here discussed. It has been described in detail by Mr. R. W. Dron in a paper contributed to the Transactions of the Institute of Mining Engineers.² To this paper we are indebted for the following information. The seams affected are the Ell, Main, and Splint; the area over which alteration has been noticed is at least

¹ Pp. 29-35. See also account of "burning" in Rosehall field given on pp. 76-8 of "Econ. Geol. Central Coalfield, Area V." (*Mem. Geol. Surv.*), 1916.

² 1904, vol. xxvii., pp. 92-4. Discussion, pp. 94-6, and 241-5.

100 acres lying to the south of the shafts, and the vertical depth reached by the "burning" rarely exceeds 300 ft. In the case of the Splint Coal the alteration may be limited to the top 6 or 8 inches, or may affect the whole seam, or again the 22-inch cannel rib in the centre may be "unburnt." The Ell Coal in places shows 5 feet of clean coal overlying 2 to 2½ feet of calcareous coal. Where the burning has affected the whole or the major part of a seam the total thickness is considerably reduced. Thus the Main Coal at one point changed within a distance of 50 feet from a normal seam 4½ feet thick to a completely "burnt" and useless one of only 1½ feet. At other points again the alteration is restricted to irregular nodules. The most marked "burning" occurs in the vicinity of faults, and the same seam may be calcareous on one side and quite normal on the other side of a fault. Mr. Dron suggests that "the local occurrence of the alteration, and the fact that it does not extend to the lower seams would lead to the conclusion that the lime had been deposited in the coal by infiltration from above at a period subsequent to the deposition of the coal-seams." This hypothesis is supported by the fact that the calcareous veins have in some places been shown to cross the bedding,¹ but on the other hand it is difficult to account for the curiously selective action of the infiltrating material. Possibly we are dealing here with two different processes, first a kind of slow oxidation of pyritous portions of the seam soon after its formation, and secondly, a later infilling of calcareous material from circulating water.

The same type of "burning" appears to affect the Ell Coal at the old Clydesdale and Cambusnethan Pits, where the following sections are recorded:—

CLYDESDALE No. 6 PIT.		CAMBUSNETHAN.	
Blaes		Fireclay and fakes	
HEAD COAL .	1 ft. to 1 ft. 2 in.	BURNT COAL .	1 ft. 6 in.
COAL .	4 ft. 9 in.	COAL .	3 ft.
BURNT COAL.	2 ft.	BURNT COAL .	4 in.

Little information is available regarding the "burning" here, but the thickness of the seam at Cambusnethan is certainly not normal.

In the workings of Thornlie Colliery at Wishaw, along the 26-fathom fault which runs parallel and close to the Caledonian Railway, there occurs a strip of "burnt coal" of varying width. This change affects all three seams worked (Splint, Main, and Ell), but is most marked in the Main. The so-called "burnt coal" is difficult to kindle, but furnishes an excellent fuel of high calorific value.

Structural Features.—The shallowest part of the Wishaw coalfield occurs in the south-east corner of Lanark 18 N.E., where the Kiltongue and Drumgray seams come to the surface on both sides of what may be termed the Law anticline. The deepest part lies in the neighbourhood of No. 3 Pit, Overton (abandoned), where the Ell Coal was wrought at 83 fms. The outcrops of the thick upper coals are several times repeated by faulting to the east and south-east of Wishaw, but west of it they are somewhat deeply buried.

¹ See "Econ. Geol. Central Coalfield, Area V." (*Mem. Geol. Surv.*), 1916, p. 76.

The master-faults have a general east-and-west or N.N.W.—S.S.E. trend, and of the two systems it would seem that the former is in the main the older. The later N.N.W. dislocations have apparently in some cases been deflected along the east-and-west lines of fracture for some part of their course, and may even shift them, but in many cases it is impossible to determine the relative ages. The Hareston-hills fault, separating the Stonecraigs and Herdshill fields, is a continuation of that which forms the southern boundary of the Morningside-Chapel coalfield. Where it enters Lanark 18 N.E., it has a downthrow to the north of approximately 46 fms. It runs eastwards past Herdshill and Harestonhills to Waterloo Reservoir, where it meets a powerful N.N.W.—S.S.E. dislocation. The latter fault has an easterly throw of about 80 fms., and to it is due the preservation of the thick upper coals of Greenhead Moss. West of the reservoir the Harestonhills fault continues as far as Green House, gradually decreasing from 15 to 3 fms. in downthrow. The name Overton fault is applied here to the fracture which crosses the Garrion Burn near Overton village, running in a general north-westerly direction through Overton, past Netherton House, and into the field of the old Clydesdale Colliery. West of this point again there is a heavily faulted area at Muirhouse and Carbarns, while the Shields and Dalzell field is traversed by faults, some of considerable magnitude, belonging to both the systems mentioned above.

Buried River Channels.—As described in the account of the Main and Ell Coals, the workings of these seams from No. 6 Pit, Sunnyside (now the Heathery Pit), struck the course of a preglacial (or interglacial) stream to the west of Wishaw. The Main and Ell Coals outcrop along the sides of the buried channel, and as far south at least as Berryhill, the upper seam has a sand roof. The old stream flowed here in a direction slightly west of south, and was a continuation of the one referred to in treating of the Cleland district (p. 83). The channel was also proved in the Ell workings at Carbarns, just north-west of the Hall Gill, and can thus be traced, from north to south, for a distance of somewhat over three miles. Between Berryhill and Green House however, its course can only be approximately inferred, since all the worked coals lie well below it. What appears to be a portion of the preglacial Garrion has been proved between Law Junction station and Law No. 6 Pit.

Reserves of Coal.—Some indications of the areas likely to be exploited for coal in the future have already been given in treating of individual seams. It may be of some use to summarise the results in a brief statement. The thick upper seams must be regarded as practically exhausted, although the stoops in the abandoned workings, old barriers and supports, and small areas left unworked for one reason or another, may yield a supply for some time to come. The Virtuewell, Kiltongue and Mid Drumgray coals show prospects of future extensive development. The first named has been worked all along the eastern edge of Lanark 18 N.E., at Stonecraigs, Herdshill, and Law, and is now raised at Wishaw, Shields, and Dalzell Collieries, but large areas of presumably workable thickness are still intact. The Kiltongue is locally poorly developed, e.g. at Shields, Wishaw, and Cambusnethan House, but is of good

thickness over most of the area. The Mid Drumgray is certainly workable over a large area in the eastern part of Lanark 18 N.E., but west of an irregular line running from Foulsykes through Greenhead Moss, and passing between Overton village and Cambusnethan House, it seems to be thin and variable. The Humph and Blackband Coals again are of workable thickness, so far as this district is concerned, only in the western part of Lanark 18 N.W. The Upper Drumgray and Smithy (or Lower Drumgray) Coals are fairly persistent, if thin, seams, and will no doubt be widely wrought in the future. A small area of Mill Coal of workable thickness occurs in the south-east corner of Lanark 18 N.E., around Law Junction Station.

A curious feature brought out by a study of the available boring evidence is that in the case of the Virtuewell, Kiltongue, and Upper Drumgray Coals a belt of minimum thickness appears to stretch from Wishaw towards Cambusnethan House.

M. M.

CHAPTER VI.

SANDSTONE QUARRIES.

AN important building-stone industry was carried on before the War at Auchinlea Quarries, about a mile to the north-east of Cleland. The sandstone quarried lies some fathoms above the Virtuewell Coal, and immediately below the thin representative of the Blackband Coal, which is seen in some of the quarries. It can be traced in bores and otherwise over a widish area extending to the west and south of its outcrop, having been wrought at Cambusnethan, and being for instance 24 feet in thickness about a mile to the west of Cleland. At the Auchinlea, Bellside, and Greenhill Quarries its thickness appears to be quite exceptional, being 60 feet on the average, while at North Auchinlea Quarry there is a record of as much as 90 feet of sandstone having been once exposed.

Through all this thickness it maintains a fairly uniform character, being a yellowish freestone, not so hard as to be difficult to work. At the time of the revision of this area (1911) the sandstone of North Auchinlea Quarry was wrought by means of the Ingersoll-Sargeant channelling machine, which was first introduced into Scotland by the owners of this quarry. Working from a horizontal surface this machine cuts vertical channels 8 or 9 feet deep and 4 or 5 inches in width. The stone is then removed by wedging, without the use of any explosive.

Cracks due to underlying coal workings cause a certain interruption of the quarry faces. The mining operations, however, have resulted in the thorough drainage of these quarries, in none of which is there any pumping machinery. At the time of the revision only Auchinlea and North Auchinlea Quarries were in actual operation. The market for the stone is mainly in Glasgow and the west of Scotland. The oldest portion of the Western Infirmary in Glasgow and the railway viaduct at Bellside, close to the group of quarries, may be cited as examples of its use. Forty years ago the material was largely used in Edinburgh, and Craig gives the following instances:¹—"Tenements in South Buchanan Street, 1878-81; Roseburn Terrace, Coltbridge, 1882; villas at Trinity, 1883 are weathering well." Merchiston Church, Dalry, was also built from these quarries prior to 1880. This source of supply fell into disuse in Edinburgh with the introduction of the harder Northumbrian stone.

At one part of North Auchinlea Quarry there is no less than 60 feet of cover, which includes 40 feet of boulder-clay. Both the

¹ "On Building-Stones used in Edinburgh." *Trans. Edin. Geol. Soc.*, vol. vi., 1893, p. 254.

recent and the disused quarries show a heavy covering of boulder-clay, and in most cases could not have been wrought to advantage except by the utilisation of this material for brick-making (*see* p. 131). In both the recent quarries odd corners of stone were ground down to form building sand, while grindstones have also been produced.

Northwards the area of sandstone recently wrought is limited by a downthrow fault, though the rock is present, and has been quarried on a small scale close to Hareshaw Farm. Eastwards it rises to an outcrop, and westwards the amount of cover would soon become too great. Southwards also the outcrop of the sandstone is interrupted by faulting, though between the limits indicated there is a good deal of ground so far unwrought. As indicating the former greater extent of the industry it may be mentioned that 390 men were employed in this group of quarries in 1893, as against 79 only in 1913.¹

The only other important sandstone quarries which have recently been wrought in the district are Bothwell Park and Bothwell Park No. 2 Quarries, on opposite sides of the main Caledonian Railway line, about a mile to the east of Uddingston. The material in both is a greyish-red sandstone, lying some distance above the base of the Barren Measures. The quarry to the north of the railway shows 100 feet of sandstone overlain by boulder-clay. In that to the south the cover consists of 20 feet of brick-clay lying on a similar amount of boulder clay, the former being used for brickmaking.

A detailed account of the quarries has been given by Mr. W. R. Smellie.² He points out that the sandstone is divided into two vertical components, the White Top Rock and the lower or Liver Rock, the two being separated by bands of micaceous sandstone. Both rocks contain about 80 per cent. of quartz and 10 per cent. of felspar. These form the chief granular constituents. As the felspars are fresh, they are not a source of weakness. In the top rock the grains are of roughly equal size, while the cementing materials include hæmatite, kaolin, and secondary silica. The rock is, however, somewhat porous. The Liver Rock contains two sizes of grains, a factor which tends to reduce porosity. In addition to the cementing materials mentioned above, there is a small quantity of carbonate. Chemical analyses made by Mr. A. Scott are given by Mr. Smellie as follows:—

	WHITE TOP ROCK.	LIVER ROCK.
Free Silica	81·87	80·12
Silicates	11·50	11·11
Iron (as hæmatite)	2·34	2·81
Ca O	1·47	2·47
Al ₂ O ₃	1·46	1·09
Water	·94	·58
C O ₂	A trace	1·70
	99·58	99·88
Sp. Gr.	1·94	2·21

¹ Home Office Lists of Quarries for 1893 and 1913.

² "The sandstones of the Upper Red Barren Measures to the east of Glasgow." *Trans. Geol. Soc. Glasgow*, vol. xiv., 1913, p. 258.

The top rock is white in colour when freshly fractured, the lower grey to liver-coloured. Both rocks assume a reddish tinge on weathering, a fact which is probably due to the spreading of the little botryoidal grains of hæmatite.

Very large blocks can be obtained from both quarries, and in the past these have provided much building material, particularly to the towns of Uddingston, Bellshill, and Motherwell. A part of the northern quarry is 200 years old, and the freshness of the faces is a proof of the good weathering quality of the stone.

The sandstone quarried is believed to form the highest part of the section in the Viewpark Colliery shafts, which are half a mile distant along the strike. There are here about 20 fathoms of sandstone, lying roughly some 100 to 120 fathoms above the Ell Coal. The bed accordingly has some lateral extension in this direction. The surface deposits are, however, 31 feet thick, and it is not known whether any part of them consists of brick clay.

Various former sources of sandstone in different parts of the area will next be dealt with in stratigraphical order. There are certain disused quarries in the strip of Millstone Grit which comes to the surface in the north-eastern corner. The material is, however, usually somewhat coarse. Sandstone has also been wrought between the Drumgray Coals, near Old Sandyford, and above the Upper Drumgray Coal, near Lauchope. A post of sandstone usually overlies the Kiltongue Musselband in the Wishaw district. It is seen to be 25 feet thick in the Garrion Gill section, but enough is not known about its quality to determine whether it is a likely subject for quarrying.

An opening was made, to the south of Cambusnethan, in the Auchinlea Sandstone, which comes to the surface in diminished thickness in this locality. The old quarry at Townhead (Lanark 12 N.W.) shows 40 feet of sandstone on a slightly higher horizon, underlying the Virgin Coal. Calcareous "lunkers" are present near the top of the quarry, and are probably an unfavourable feature. A sandstone just above the Splint Coal was quarried near the village of Waterloo. The quarry face shows 20 feet of soft false-bedded sandstone, with faky bands, nodules of kingle, and coaly streaks.

A sandstone of rather superior quality was worked in the old Holmhills or Kirkburn Quarry to the south of Cambuslang. The rock is about 35 feet in thickness, and lies only a foot or two above the waste of the Humph Coal. As a result of its position no pumping was necessary, but cracks have been produced, especially in the lower part of the sandstone, which somewhat interfered with the working of the quarry. The rock as a whole is white in colour, and was all dressed into blocks; hence no explosives could be used in its extraction. The refuse was riddled, and the siftings employed for building sand and in the making of concrete. The stone was in demand locally and in some parts of Glasgow, but the cover consisted of about 20 feet of hard blue boulder clay, and operations were discontinued about ten years ago. A feature of this sandstone was the somewhat notable development of kaolin ascertained by microscopical examination to occur interstitially between the sand grains.¹

¹ See "The Geology of the Glasgow District" (*Mem. Geol. Surv.*), 1911, pp. 245-249.

A sandstone above the Main Coal was quarried a little to the north-west in the "Kirkburn Quarry," shown on Lanark 11 N.W. This was also the horizon of the old quarries in and near the Templehall Plantation, to the north of Wishaw. There were four distinct quarries at this locality, in a post of at least 35 feet yellow weathering, false-bedded sandstone (*see* p. 116), which, like those of Kirkburn and Auchinlea, is cracked by subsidences caused by the working of the underlying coal. It is probable that the rock continues near the surface, for a short distance to the north-west of the existing quarries. More correctly speaking this sandstone lies above the Pyotshaw Coal, which is united to the Main at Kirkburn.

Where the coals are some distance apart, the intervening rock often consists largely of sandstone. A massive sandstone in this position has been quarried on the east bank of the South Calder, to the north of Coursington Bridge. The rock is also well exposed, a little farther down the stream, where it is seen to be 40 or 50 feet in thickness, and has been carved into various life-sized figures.

A disused quarry occurs in a yellow false-bedded sandstone, just below the Ell Coal, at Pickerstonhill (Lanark 12 N.E.). Next in order of succession is a grey and reddish sandstone, about 30 fathoms above the Ell Coal, which was worked at Stonelaw, to the south of Rutherglen. A coarse yellow sandstone, probably about 33 fathoms above the Ell, was opened up in an old quarry, on the south side of the Thankerton Burn, about a quarter of a mile east of Mossend Station.

An old quarry on the Wishaw Estate, to the east of Shieldmuir, shows a light brown sandstone about 30 fathoms above the Ell Coal. The adjacent ground was very thoroughly proved by boring, in the year 1877, with a view to the extension of quarrying operations. The "tirling" was found to vary from 22 to 50 feet, and the rock itself from 60 to 68 feet in thickness.

There is also a disused quarry, in the lower of the two sandstones, seen in the banks of the South Calder Water near Ravenscraig (*see* p. 82). This sandstone must be over 30 fathoms above the Ell Coal, but there is here no trace of reddening.

The sandstones which remain to be noticed show, as a rule, the characteristic reddish staining of those in the Barren Measures, though it is uncertain whether that at Eastfield actually overlies Skipsey's Marine Band. These sandstones are often fairly good, so far as weathering properties are concerned. They are, however, disfigured by the irregularity of the staining and are further impaired by the presence of clay galls, and in consequence they have most generally been used for inside work and rubble. There are, however, exceptions to the above rule.

Apart from the Bothwell Park Quarries already described, perhaps the most important source of these reddish building-stones was at Eastfield, near Cambuslang. The latest quarry at this locality was in operation till 1910. A 60-foot face of sandstone was here exposed. The upper part contains galls of clayey hæmatitic matter, which are surrounded by deep red haloes, but these are almost absent from the lower portion of the quarry, which in consequence could be used for

a superior class of work. Bothwell Street and Silverbank Street in Cambuslang as well as the south side of Calderwood Terrace in Rutherglen, are stated to have been entirely built from this material. The Eastfield rock lies about 40 fathoms above the Ell Coal. The old West Quarries, on the opposite side of Rutherglen, were on a horizon about 10 fathoms higher.

Two old quarries, somewhat west of Flemington Station, worked a rather coarse-grained brown or yellow sandstone at a level a little above the last referred to. The red Hamilton Sandstone, which forms a comparatively constant feature in the southern part of the area, was wrought at the two Tuphall Quarries, within the burgh of Hamilton. These are now practically filled up, but the more westerly showed at least 18 feet of solid sandstone, under 12 feet of a more "faky" character. The Hamilton Sandstone was also quarried to a small extent on the banks of the Avon gorge, close to Chatelherault.

The material formerly worked at Thornwood Quarry (close to Uddingston West Station), and at Bredisholm Quarry (Lanark 11 N.E.), seems to have been very similar in character to that of Bothwell Park. Owing to rapid variation, it is difficult to trace any particular sandstone in the Barren Measures for any great distance. Judging by the height above the Ell Coal, the Bredisholm Sandstone would seem to be a little lower, and that of Thornwood Quarry a little higher, than the Bothwell Park Sandstone.

The stone from Bredisholm was much used for building in the town of Coatbridge, and the following structures may be cited as examples of its use:—Gartsherrie Public School, Coatbridge; United Presbyterian Church, Blairhill; St. Joseph's Roman Catholic School, Tollcross; Established Church, Yoker, near Clydebank. An analysis by Dr. John Clark (former City Analyst, Glasgow) gave the following results:—

Silica	.	.	.	.	90.50
Alumina	.	.	.	.	7.70
Oxide of iron.	.	.	.	.	9.92
Carbonate of lime	.	.	.	.	3.10
Carbonate of magnesia	.	.	.	.	2.72
Combined water	.	.	.	.	1.38
Moisture	.	.	.	.	0.70
					100.02
Specific gravity	.	.	.	.	2.424
Water absorbed by immersion of air-dried stone, per cent.	.	.	.	.	5.20

This quarry has been disused since 1908. The rock-face was about 30 feet in height, with a cover which consisted of 10 or 15 feet of boulder-clay.

The thick sandstone at the top of the Corby Craig section (*see* p. 67) is on somewhat the same horizon as the group just referred to. It has been wrought to a small extent near Wallace's Cave, and is a yellow sandstone of medium grain, at least 50 feet in thickness. It contains some lenticles of clayey matter, and occasional pyrites nodules.

A solid red sandstone, over 20 fathoms in thickness, occurs near Hamilton in a position extending roughly from 105 to 130 fathoms above the Ell Coal, and thus some distance above the Hamilton Sandstone. There is here also a general correspondence with the rock of the Bothwell Park Quarries, though the horizon cannot be traced between the two localities. It was this sandstone which was wrought, a few years ago, on opposite sides of the Cadzow Burn, to the north of Eddlewood. The rock is here rather coarse grained, soft, and friable. It was probably the same bed which was quarried near Laigh Townhill.

The highest sandstone known to have been utilised in the area is that which was quarried at the Hallside Terra Cotta Works, about three-quarters of a mile to the east of Hallside Steel Works. It is a purplish, streaky, fine-grained, micaceous sandstone, about 170 fathoms above the Ell Coal, and immediately underlying the marl or fireclay already referred to (p. 42).

C. T. C., E. M. A., M. M.

CHAPTER VII.

SUPERFICIAL DEPOSITS.

THE clays of this district are of some degree of importance to the brickmaking industry, and the sands are also, in one or two cases, of industrial use. Apart from this, the surface deposits have an agricultural interest; they have to be taken into account in the sinking of pits, in questions of drainage and sanitation, as well as for numerous other objects. As stated in the Introductory Chapter, a separate series of six-inch maps is issued by the Geological Survey, in which sands and clays, etc., are represented by means of distinctive colours.

These surface materials may be roughly divided according to their order of formation, which in many cases is also an order of superposition. In the present area the order is as follows:—

- (i.) Glacial deposits.
- (ii.) Deposits of the 100-foot raised beach or terrace.
- (iii.) Recent deposits.

The first division includes the boulder-clay, which occupies so great a surface area, especially in the eastern part of the district. It includes also sand and gravel older than the great bulk of the boulder-clay, and usually underlying it, though sometimes exposed at the surface. Certain sands and brick-clays interstratified with the boulder-clay must also be glacial in origin, but they are not of much economic importance. There are, however, in one part of the area, wide deposits of sand, gravel, and brick-clay which overlie the boulder-clay, but from their height above sea-level cannot belong to the 100-foot deposits, which consist typically of brick-clay. The latter form a cover to those already mentioned over much of that part of the area which is less than 100 feet above sea-level. The third division includes stream and river alluvium, as well as peat.

Sands and gravels older than the boulder-clay.—The sand and gravel referred to as being older than the boulder-clay occurs mainly in the narrower series of buried river channels to which reference has already been made in Chapters IV. and V. The boulder-clay covering which is usually present prevents the material from being quarried. A possible exception occurs at Ravenscraig Sand-pit, near Nether Johnston, but, as already stated (p. 70), it is uncertain how the great thickness of sand and gravel, which is known to occur here, should actually be classed. The quarried face shows:—

		Fms.	Ft.	In.
Boulder-clay	2 ft. to	0	3	0
Gravel		5	0	0
Sand		2	3	0

Part of the sand is used for building; another part as an ingredient in a mixture which is used for the bottoms of steel furnaces. A bore from the bottom of this pit passed through a hundred feet of sand, without meeting with the rock surface.

A bore just east of Motherwell Iron and Steel Works shows about 15 fathoms of superficial deposits, mainly consisting of sand and gravel, resting directly on the solid rock. There can be no doubt, in this case, that the unusual thickness is due to the fact that the bore has struck the line of the buried channel which passes Coursington Colliery, and has been described on p. 70. Another buried channel is crossed by the South Calder Water near Wishaw House (*see* p. 83), and the boulder-clay covering has been removed by the erosive action of the stream. Two small sand-pits were formerly wrought in the material, on either side of the Temple Gill.

Even where there is no suspicion of an underlying channel, there is occasionally some thickness of sand beneath the boulder-clay. At Orbiston Colliery (Lanark, 11 S.E.) 60 feet of sand and gravel underlie 36 feet of the latter deposit.

The wider buried channels of the Clyde and Avon will be dealt with under a separate heading.

Boulder-Clay.

Boulder-clay is the surface formation over most of the eastern and southern part of the area, as well as of some of the higher ground in the district farther west. It is sometimes red, but perhaps more often grey in colour, and is not in the main arranged in drumlins, as in some parts of the area to the north (Area V.). It reaches perhaps a maximum thickness near Blantyre Colliery, where 76 feet of this material were shown in a bore to be overlain and underlain by sand and gravel.

The boulder-clay has been extensively utilised for brick-making at the Auchinlea Quarries (*see* p. 125) as well as at the disused Bellside Quarries, a little farther south. It here varies from about 12 to 40 feet in thickness. At North Auchinlea Quarry, at the time of the revision, the clay was removed by gelignite. Gunpowder had formerly been used, but was found to break the material into too large fragments. The larger stones were removed by hand; what remained was then ground and burnt in Newcastle kilns. In places the surface clay was free from stones, and yellow perhaps from oxidation. This finer material was used to give a part of the bricks a coating. The boulder-clay was not in itself a paying subject in these quarries, but had to be removed to obtain the sandstone.

Boulder-clay is also used at a brick-works near Carfin Colliery. About 12 feet were here exposed at the time of the revision. The base was brownish-grey in colour, which gradually changed to a mottled pale grey, or pink, nearer the surface. This clay is freed from the larger boulders, then ground in a pug-mill, with blaes from the adjacent pit, to make composition brick.

An interlamination of the boulder-clay with beds of sand, gravel, and brick-clay, is a very common feature in the western and central parts of this district. It was at one time well seen, for instance, in a railway cutting to the north of Bellshill. The difficulty of mapping this type of surface deposits can be readily imagined. Much of the "boulder-clay" shown in the published maps of Lanark 11 is really of this composite nature.

Sands, gravels, and brick-clays, overlying the boulder-clay.—These deposits often reach a considerable thickness. They extend in a vertical direction to more than 200 feet above sea-level, and on the north side of the Clyde form a fairly constant capping to the boulder-clay up to about this contour. On the southern side the covering appears to be less regular, and has not always been mapped.

A brick-clay belonging to this series is being used for brickmaking at Bothwell Park Quarry. It is about 20 feet in thickness, and rests upon about 20 feet of boulder clay, which is mixed with sand and gravel. The brick-clay also occurs in a cutting on the Hamilton Palace Colliery Railway, about half a mile to the south of the quarry referred to. A good natural section of the same material is visible on the north-east bank of the Clyde, about half a mile south-east of Hamilton Palace Colliery. At least 20 feet of the laminated clay rests on dark grey boulder clay, which overlies a laminated clay in one part of the section. The upper clay extends from the river bank almost as far as Motherwell, being indicated, for instance, by the absence of stones at the surface near Low Motherwell Farm.

There is also evidence of its occurrence on the opposite side of the river. At No. 1 Pit, Whistleberry, the surface deposits read as follows:—

	Fms.	Ft.	In.
Surface	.	0	4 2
Soil and yellow clay	.	1	0 6
Fine muddy clay	.	3	0 4
Red sandy clay and stones	.	1	0 0
Rock-head			

The second and third items are no doubt the clay under discussion. There were former clay pits in this material at the old Birdsfield Tile Works (half a mile west of Greenfield), near Stonefield, and to the west of Caldergrove. A good section of laminated clay was formerly exposed at the top of the quarry attached to the Hallside Terra Cotta Works (*see* pp. 42 and 129). The material here rests on boulder clay, with which, near its base, it is somewhat mixed. There is thus, in all probability, a fairly wide spread of brick-clay between Uddingston and Motherwell, and on the south side of the river between Hallside and Hamilton. The covering is not likely, however, to be very regular, nor has it been ascertained whether, on a large scale, the material is suitable for brick-making.

Farther to the west there is a belt of mounchy ground, in which the capping of the boulder-clay consists more generally of sand and gravel. This can be traced, from Broomhouse and Daldowie, southwards by Redlawood and Hallside, as far as the flanks of Dechmont Hill, near Flemington Farm. Several deep cuttings have been made through it, and show the base of the sand and gravel to be often water-bearing, with a consequent tendency to the production of slip. The sand was dug in an old pit rather more than a quarter of a mile north-east, and in another just south, of East Hallside. In the former it is mixed with fine partings of red clay.

Another important spread of sand and gravel extends along the south side of the Clyde alluvium, from Hamilton to a point about a mile to the north of Larkhall. The lower part of the town of Hamilton is built on these deposits, which are rather extensively

wrought at the Deer Park or Ferniegair sand pit, a mile or so to the south-east. The quarried face is at one point 50 feet in depth, and the material includes both fine and sharp sand, with some thin beds of clay, and pockets of gravel. A rather persistent bed of coarse gravel runs round the top of the quarry, and forms perhaps the remains of a greater thickness of sediment, from which the finer material has been leached by atmospheric erosion. The gravel is used for concrete, and the sharper part of the sand is largely employed for pig-beds for blast furnaces. The material was formerly much used as a building sand, and is now used for moulding, for plaster, for bowling-greens and gardens, and for sanding the rails of tramways and railways. The extent of the deposit is large enough to allow of considerable further development. The clay beds are spread over the floor of abandoned parts of the quarry, which can then be used for allotments. The total thickness of sand has not here been tested. At Ferniegair Colliery it does not amount to 60 feet.

Buried Channels of the Clyde and Avon.—An exceptional thickness of surface deposits occurs at Ross Colliery, where nearly 19 fathoms of "mud and sand" overlie 2 fathoms of boulder-clay, which rests in turn on the solid rock. Large thicknesses of similar materials extend from this point in a continuous belt, over half a mile in width, which borders the River Clyde for some miles to the south-east. These were quite possibly laid down at the same period as the sands, gravels, and brick-clays described under the last heading, but they may with little doubt be regarded as filling an old hollow, which was formed, in the first place, by the erosion of the river. The narrower channels already dealt with are mainly filled with sand which is earlier than the boulder-clay. In the Clyde channel, on the other hand, boulder-clay, where it has been recorded, is usually the lowest item. This is the case at Ross Colliery, and also to some extent in the Govan and Renfrew district, described in another section of this Memoir.¹ It appears in fact as if any sandy deposits, which were earlier than the latest glaciation, had in this case been in the main removed by subglacial erosion. We might not inconsistently expect to find such deposits in the narrower valleys whose steeper sides would no doubt protect them.² It seems likely also that subglacial erosion may have somewhat deepened and modified the form of the pre-existing Clyde valley. The latter can, for instance, be traced from Clydebank to Cambuslang, and from near Hamilton Palace Colliery, in a south-easterly direction, to beyond the limits of the present area. It attains a depth of 11 feet below sea-level as far up the river as Upper Carbarns. But between Bothwell and Cambuslang it has not yet been traced, and it seems unlikely that it can everywhere descend to sea-level. This peculiarity can be partly explained if we suppose the stretch above Hamilton to have been glacially over-deepened. Near Upper Carbarns the southern slope of the old valley can be ascertained by comparing the depth at which rock has been met with in numerous bores. Its gradient was here fairly steep.

¹ "Econ. Geol. Central Coalfield, Area IV." (*Mem. Geol. Surv.*), in the press.

² Cf. James Geikie, "The Great Ice Age," 1894, pp. 108, 109.

The present course of the Clyde is often near, but not usually directly above, the deepest part of its buried channel. It is outside the channel altogether (to the north-east) at Camp Railway Viaduct, where rock appears on the river bank.

Round Merryton and Allanton Collieries there is evidence of a similar, but tributary, channel. This must have been formed by a stream which drained somewhat the same area as the present river Avon. The depth of its base from the present surface is not less than 173 feet at a point to the south of Merryton. In sinking one of the shafts of Allanton Colliery the mud, clay, and gravel filling the channel were found to rest on a bed of coarse blocks and rubble, so loosely compacted that an arm could be thrust between. This rested directly on solid rock.

DEPOSITS OF 100-FOOT TERRACE OR RAISED BEACH.

These deposits consist largely of workable brick-clays to the west of Rutherglen. Disused clay-pits occur near Mount Florida, and at a number of points between this and Polmadie, as well as farther east. The material is still being worked by Messrs. J. Paterson and Son, Ltd., in a pit near Polmadie Road. Ten feet of sand and sandy clay are here exposed resting on 20 feet of purer clay, improving in quality downwards. The clay was worked to a depth of 70 feet in a pit not far to the north. It is mixed with the more sandy material of the surface layers, and with a little ash, for the making of wire-cut brick.

East of Rutherglen the clay appears either to change laterally into sand, or to become covered by that material. A bore near Stonelaw Colliery gave:—

	Fms.	Ft.	In.
Sand	6	4	6
Laminated mud	9	0	0
Sandstone			

A sand-pit was at one time wrought to the north-east of Cambuslang, a short distance above the 50-foot contour, while at the adjacent Westburn Colliery the rock-covering consists entirely of sand and gravel. In the circumstances the actual presence of 100-foot beach deposits so far up the Clyde valley must remain an open question, but even if present they do not likely contain any workable brick-clay.

RECENT DEPOSITS.

Alluvium.—The Clyde alluvium in this district is on the whole a sandy deposit, but river alluvia seldom contain sand of sufficient purity to be useful for industrial purposes.

Peat.—Perhaps the greatest thickness of this deposit occurs in the Greenhead Moss, to the south of Cambusnethan. Bores show that the moss is sometimes as much as 26 feet in depth, and the lateral extent is about a quarter of a square mile. There is another extensive peat moss to the north-west of Newmains, and several occur in Lanark 12 N.E. None of them, so far as is known, has been used except locally for fuel.

C. T. C., E. M. A., C. H. D.

APPENDIX.

GLOSSARY OF SCOTTISH MINING TERMS USED IN THIS MEMOIR.

* Definitions marked with an asterisk are taken from "A Glossary of
Scotch Mining Terms," by James Barrowman, 1886.

Bastard.—Impure, *e.g.* bastard fireclay, impure fireclay.

Blacks.—Coaly blaes.

Blaes.—Mudstone, or shale in the geological sense, not containing much bituminous matter.

Blankets.—A term applied in the Cleland district to a layer of hard blaes coming between the Virtuewell Coal and the overlying oil-shale.

Blind Bore.—A bore put down from an underground working.

Bonnets.—Gas coal or shale overlying and sometimes worked along with a coal seam.

Brushing.—Strata above or below a worked seam taken out in making the roads.

Calmy Limestone.—Argillaceous limestone.

Composition Brick.—Brick made from ground blaes or fireclay of inferior quality. Often there is an admixture of some surface-clay, and occasionally the name is applied to a brick made entirely from boulder-clay.

Craw Coal.—Inferior coal.

Daugh.—Soft coaly fireclay, when found above, below, or as a parting in a coal seam.

Doggers, Doggar, Doggart, or Dugger.—Irregularly shaped nodules or concretions. Sometimes used for inferior ironstone.

Dyke.—A "whinstone dyke" is a dyke, in the geological sense, consisting of igneous rock. Otherwise the term dyke is applied to a large fault. *See* however under "Sand Dyke."

Fakes.—Thin-bedded argillaceous sandstone, or sandy mudstone.

Float.—A sill or sheet of igneous rock, either horizontal or inclined more or less in accordance with the bedding.

Free Coal.—Coal with a bright lustre and cubical fracture, as opposed to Splint or Gas Coal.

Gaw.—A dyke of igneous rock.

Hitch.—A fault, and more especially a small fault.

Holing.—The excavation of a thin layer of soft material beneath, above, or in the centre of a coal seam, as a preliminary to working it; or the layer so excavated.

- Ingoing Eye or Ingaun Ee*.—The mouth of a drift or mine from the surface.
- Kingle*.—Very hard sandstone, either siliceous or cemented by carbonates.
- Lipey*.—Intersected by glazed joint faces.
- Lunker*.—A hardened lenticular mass of sandstone cemented by carbonates, or a big nodule, *e.g.* of clayband.
- Mine*.—A drift either from the surface (Ingoing Eye or Day Level) or from underground workings (Cross-cut, Stone Mine); not a pit.
- Mussels*.—Fossil bivalve remains, usually of species of *Carbonicola*, but *Naiadites* and *Anthracomya* are sometimes so referred to.
- Musselband*.—An ironstone or blaes crowded with "mussels."
- Parrot Coal*.—A term for gas coal, often but not always restricted to such as is of inferior quality. The name has probably been derived from the crackling noise made by this type of coal in burning.
- Pavement*.—The layer immediately underlying a coal or other workable seam.
- Plies*.—Rapid alternations of strata of differing character.
- * *Pugs*.—A stratum of hard coal in a free coal seam, *e.g.* in the Main Coal seam of Lanarkshire.
- Rock*.—Hard sandstone.
- Roof*.—The layer immediately overlying a coal or other workable seam.
- Sand Dyke*.—A narrow preglacial or interglacial channel filled with sand, such as sometimes interrupts the workings of a shallow coal seam.
- * *Scrit*.—Coaly blaes or slaty coal.
- Shale*.—In Scottish mining parlance used only for bituminous or oil shale.
- Shaly Blaes*.—Bituminous blaes, not so rich as to be termed "shale."
- Slatyband Ironstone*.—A fissile ironstone consisting of alternating clayband and blackband laminæ.
- Splint Coal*.—Hard coal with a dull lustre, which does not cake or break up in a furnace.
- Stoop*.—A broad pillar of coal or any other mineral left in to support the roof of a working.
- Stoop and Room*.—A system of working a seam by a network of galleries, separated by broad pillars or stoops.
- Tirring*.—The covering of useless material overlying the worked rock in a quarry.
- Whin or Whinstone*.—A term largely applied to hard igneous rock, though used also for other hard material.
- Wild Coal or Wild Parrot*.—Inferior coal or gas coal respectively.

INDEX.

- AIKENHEAD**, 8.
Airdrie Blackband Coal, 56, 77.
 — Ironstone, 77.
Allanshaw Colliery, 93, 98.
Allanton Colliery, 89, 97, 134.
Alluvium, 134.
Analyses, 13, 22, 61, 73, 74, 75, 125, 128.
Armada Coal Group, 5, 105.
Auchinlea Quarries, 124, 131.
 — Sandstone, 77.
Avon, Buried channel of, 102, 133.
 — Bridge Fault, 102.
 — Gorge, 100.
Avonbrae Coal Group, 100.

BAILLIESMUIR PIT, 73.
BAIRD & Co. LTD., Wm., 21.
Balmoral Coal, 5, 20, 21, 72. *See also*
 Mill Coal.
Bankhead, 16, 17, 18.
Bannockburn Main Coal, 10, 11.
Barncluith, 94, 97, 101.
 — Coal Group, 101.
Barren Measures, 3, 5, 18, 19, 20, 41,
 67, 100.
BARROWMAN, J., 18.
Belhaven Colliery, 53, 61.
Bellshill Colliery, 33, 34.
Bellside Ironstone, 76, 110.
Bent Colliery, 90, 92, 93, 94, 96, 97,
 98.
Biggins Farmyard bore, 48, 49, 56.
Birniehill, 13.
Black Metals, 8, 11.
Blackband Coal, 5, 17, 20, 21, 27, 56,
 93, 112.
 — Ironstone, 65, 76, 77, 81, 110.
Blantyre, 24, 25, 26, 27, 29, 33, 35, 37,
 40.
Blantyreferme, 34.
 — Colliery, 35, 38, 39.
Bog Colliery, 89.
Bogfield Colliery, 26.
Bogleshole Pit, 21, 25, 38.
Bothwell, 25.
 — Castle Colliery, 31, 33, 41.
 — district, 19-45.
 — Fault, 43, 44.
 — Park Colliery, 28.
 — Park Quarries, 125.
Boulder-clay, 131.
Bowhousebog Coal, 13.
Braidhurst Fault, 69.

Bredisholm Colliery, 22, 24, 26, 27, 32,
 39, 42.
 — Quarry, 128.
Brick-clay, 132, 134.
Brick-making, 8, 13, 42, 56, 107, 131,
 134.
"Brockhill Dyke," 102.
Broomhouse Colliery, 21, 23.
Buried channels, 70, 83, 102, 122, 130,
 133.
Burnlip, 10.
"Burnt" Coal, 29, 31, 32, 35, 120, 121.

CADZOW COLLIERY, 89, 90, 91, 92, 94,
 95, 96, 98.
Calcareous Coal, 29, 32, 120.
Calcareous Sandstone Series, 3, 7.
Calderbank Colliery, 21.
Calmy Limestone, 9, 11.
Cambuslang, 7, 30, 36.
 — Marble, 18, 36, 98.
Cambusnethan, 11, 14, 119, 122.
Camp Colliery, 112.
Carbarns, 109, 113, 114.
Carbonicola, 17, 18.
 — *aquilina*, 36.
Carboniferous Limestone Series, 3, 7-11.
Carfin, 56.
 — Colliery, 55, 59, 132.
Carmyle, 21, 38, 43.
Castlecary Limestone, 13.
Castlehill, 115, 118.
 — Orchard, 119.
Castlemilk, 8.
Cathkin Hills, 3, 7.
Cement Limestone, 12, 14.
Chatelherault Sandstone, 101.
CLARK, DR. J., 128.
Clayband Ironstone, 8, 54, 55, 77, 111,
 112.
Clefted Coal. *See* Balmoral Coal.
Cleland Colliery, 77, 78.
 — district, 70-85.
 — Roughband Ironstone, 26, 54, 77,
 93, 112.
 — Townhead, 78, 80.
Clyde, Buried channel of, 102, 134.
 — River, 120.
 — Ironworks Colliery, 21, 26, 38.
Clydesdale Colliery, 116, 121.
Clydeside Colliery, 23, 26.
Coal Measures, 3, 15-123.
Cocksburn Reservoir, 7.

Coltness Iron Works, 114.
 Composition brick, 8, 131.
 Corby Craig, 67.
 Coursington Colliery 48, 55.
 CRAIG, G., 124.
 CRAIG, J., 5.
 Craighead Colliery, 20, 23, 24.
 Crofthead Coal, 72.
 — Slatyband Ironstone, 16.
 Crosshill, 16.
 Crutherland Coals, 8, 11.

DALZELL COLLIERY, 48, 55, 109, 112,
 114, 118.
 Dechmont Fault, 4, 7, 8, 20, 43, 44,
 102.
 — Hill, 7.
Derbya, 12.
 Dike-end, 8.
 DIXON LTD., Wm., 13, 18.
 Dolerite sills, 8, 82.
 Douglas Park Colliery, 23, 27, 32, 37.
 DRON, R. W., 5, 30, 32, 60, 70, 120, 121.
 Drumgray Coal Group, 87.
 Dykes, sand, 70.
 — whinstone, 44, 70.

EARNOCK COLLIERY, 91.
 Earnockmuir, 9.
 East Parkhead Colliery, 22, 23, 27, 37.
 Eastfield Quarry, 18, 127.
 Eddlewood, 91, 95, 98.
Edmondia punctatella, 11.
 Ell Coal, 5, 18, 20, 36, 62, 81, 98, 117.

FAIRHILL, 96.
 Farne Colliery, 16, 18.
 Faults, 4, 19, 43, 68, 82, 102, 122.
 Ferniegair, 96, 97.
 Fireclay, 13, 56, 107.
 — Craw Coal, 10.
 Fishescoats Colliery, 17.
 "Floats," 8, 80, 82.
 Foot Main Coal, 17.
 Foul Hsie Limestone, 8.
 Foulisykes, 76.

GALENA, 12.
 Garrion Burn, 111, 115, 119.
 Garriongill Colliery, 109.
 Gartsherrie, 10.
 Gateside, 21, 22, 23, 25, 26, 30, 33, 35, 39.
 GEIKIE, PROF. J., 133.
 Glacial deposits, 130.
 GLASGOW COLLIERY CO., 34.
 Glencleland Colliery, 79.
 Glossary of Scottish Mining terms, 135-
 136.
 Goodockhill Slatyband Ironstone, 12.
 Govan Blackband Ironstone, 8.
 — Colliery, 13, 16, 17.
 Gravel, 130, 132, 133.
 Green Colliery, 116.

Greengairs, 29.
 Greenfield Colliery, 27, 32, 34.
 Greenhead Moss, 108.
 Greenhill Colliery, 75, 76.
 Greenleashill, 7.
 Greenside, 78.
 GROSSART, DR., 12, 76.

HALLSIDE COLLIERY, 19, 30, 36, 38, 43.
 — Terra Cotta Works, 42, 129.
 Hamilton, 86, 101, 132.
 — district, 85-103.
 — Palace Colliery, 26, 31, 34, 35,
 37, 38, 40, 41.
 — Sandstone, 101, 128.
 Hareshaw Fireclay, 13.
 Harestonhills 108.
 — Fault, 122.
 Hattonrigg, 52, 58.
 Haughhead, 22, 26, 34, 38, 39, 40, 41, 42.
 — Fault, 43.
 Heathery Coal Pit, 111.
 Herdshill Colliery, 107, 111.
 High Blantyre, 7, 8, 40.
 — Crosshill, 17.

Highleas, 99.
 Hirst Coal, 9, 10.
 Hogg Fence Ironstones, 10, 11.
 Holmhills Farm, 30, 33.
 Holytown Colliery, 53, 54, 63, 69.
 Home Farm Colliery, 92, 95, 96, 97.
 Hosie Limestones, 10.
 Househill Clayband Ironstones, 8.
 Howmuir Pit, 76, 80.
 Humph Coal, 18, 33, 34, 60, 79, 95,
 114.
 Hundred-foot terrace, 134.
 Hurlet Limestone, 8.

INDEX LIMESTONE, 8, 9, 11.
 Intrusive dolerite, 8, 80, 82.
 Ironstones, 8, 10, 12, 54, 65, 76, 77, 81,
 110, 111, 112.

JERSEY BRIDGE BORE. *See* Muirhouse
 bore.
 Jewel Coal, 10.

KENMUIR COLLIERY, 23, 30.
 Kenmuirhill, 24, 26, 29, 34, 38.
 Kennelburn Ironstone, 52.
 Kilsyth Coking Coal, 8, 10, 11.
 Kiltongue Coal, 15, 16, 17, 24, 50, 52,
 75, 87, 88, 91, 108.
 — Musselband Shale and Ironstone,
 17, 53, 75, 91, 110.
 Kingshaw Limestones, 10.
 Kirk Burn, 35, 36.
 Kirkburn Quarries, 34, 126.
 Knownoblehill, 77.

LADY EMILY PIT, 117.
 Ladygrange Coal, 17, 26, 54, 75.

- Ladymorton Coal, 10.
 Lauchope, 49, 52.
 Law Colliery, 109.
 Legbrannock Burn, 57, 81.
 — Colliery, 50.
 Lesmahagow Gas Coal, 11.
 Letterick, 40.
 Limestone Coal Group, 3, 7-11.
Lingula, 14, 66.
 Logans Bands, 8.
 Lower Drumgray Coal, 5, 20, 21, 23, 48,
 73, 83, 88, 89, 106.
 — Garscadden Ironstone, 8.
 — Limestone Group, 3, 7, 8, 10.

 MACCULLOCH, J., 5.
 MACGREGOR, M., 109.
 M'QUEEN, D., 61, 73, 74, 75.
 Main Coal, 5, 18, 34, 61, 80, 96, 115.
 — Limestone, 8.
 Maps, Styles of, 1.
 Marble, Cambuslang, 18, 36.
 Marl, 41, 42.
 Meadowhead Pit, 79.
 Meiklehill Main Coal, 11.
 Merrytown Colliery, 94, 99.
 Mid Drumgray Coal, 73, 90, 107.
 Middle Johnston Colliery, 55.
 Mill Coal, 87, 105. *See also* Balmoral
 Coal.
 MILLER, J., 64.
 MILLER, J. D., 22.
 Millstone Grit, 3, 4, 11-14, 126.
 Milnwood Colliery, 47, 49, 56, 59, 64.
 Mining history, 5.
 Mining terms, 135-136.
 Moss Pit, 117.
 Mossdale Coal, 39.
 Mossend district, 46-70.
 Motherwell, 47, 66.
 — Colliery, 49, 53, 59, 69.
 — district, 46-70.
 Muirhouse Bore, 9, 11, 12, 13.
 Murdostoun Colliery, 73, 75.
 Murdostoun House, 73.
 Musselband Coal, 17, 29, 57, 79, 113.
 — Ironstone, 57.

 NEILSLAND COLLIERY, 90, 93.
 Nether Johnston Colliery, 55.
 "New Ironstone," 8.
 New Stevenston Fault, 69.
 Newarthill, 5, 77.
 — district, 70-84.
 Newhouse Bore, 72.
 Newton Colliery, 23, 25, 29.
 NICOL, J., 5.
 North Calder Water, 42, 43.
 — Motherwell Colliery, 32, 59, 61,
 62, 65.
 — Motherwell Fault, 69.

 OIL, DISTILLATION OF, 32, 54.

 Oil shale, 17, 25, 53, 54, 75, 77, 92,
 110, 111.
 Orbiston Colliery, 27, 31.
 Orchard Limestone, 9.
 Orion Pit, 33, 39.
 Output of coal, 5.
 Over Johnston Colliery, 55.
 Overton, 115, 116, 119.
 — Colliery, 114.
 — Fault, 122.

 PALACECRAIG BLACKBAND IRONSTONE,
 40, 64.
 Parkhead Colliery, 57, 60, 111, 112,
 114, 117.
 Parkneuk Colliery, 62.
 Pather Colliery, 119.
 PARTICK, REV. W., 5.
 Peat, 134.
 Pickerstonhill, 81.
 Possil Series, 8.
 Pyotshaw Coal, 34, 35, 61, 62, 80, 97,
 115.

 QUARRIES, SANDSTONE, 12, 18, 34, 42,
 124-129.
 —, Whinstone, 7, 83.

 RAISED BEACH DEPOSITS, 134.
 Ravenscraig Gorge, 82.
 Red Barren Measures, 3, 5, 18, 19, 20,
 41, 67, 100.
 Reserves of Coal, 28, 44, 102, 122.
 Road Metal, 7.
 Rosebank Bridge, 33, 39, 43.
 Rosehall Bridge, 43.
 — Colliery, 22, 26, 32, 37.
 Ross Colliery, 89, 93.
 Rutherglen, 8, 18.
 — district, 15-19.
 Roughband Ironstone, 26, 54, 77, 93,
 112.

 SALTER, J. W., 12.
 Sand, 130, 132-134.
 — dykes, 70
 Sandstone quarries, 12, 18, 34, 42,
 124-129.
 SCOTT, A., 125.
 Shale, 17, 25, 53, 54, 75, 77, 92, 110, 112.
 Shieldmuir, Colliery, 111, 114, 116
 Shields Colliery, 107, 108, 109, 111,
 114, 117.
 Shirrel Burn, 64, 66.
 Shotts Gas Coal, 48, 72, 106.
 Sills, 8, 80, 82.
 Skipsey's Marine Band, 3, 18, 20, 42,
 47, 65, 66, 99, 100, 119, 120.
 Slatyband Ironstone, 12, 71.
 SMELLIE, W. R., 125.
 Smithy Coal, 106.
 Sourmilk Coal, 17.
 Spindleside Pits, 76.

Splint Coal, 3, 5, 8, 17, 20, 29, 32, 79, 94, 113.
 — Main Coal, 17.
 South Calder Water, 41, 66, 67, 73, 77, 80, 82, 127.
 Stonecraigs, 111, 115, 117.
 Stonelaw Quarry, 18.
 Sunnyside, 116.
 Superficial deposits, 130.
 Swinhill Colliery, 18.

 TAIT, D., 66.
 Tannochside Colliery, 22, 23, 24, 26, 27, 28, 32, 35, 39, 40, 41.
 TATLOCK & THOMSON, MESSRS. R. R., 13.
 Temple Gill, 131.
 Thankerton, 56, 63.
 Thornlie Colliery, 114, 118.
 Tillan Burn, 9, 71, 74, 75.
 Tower Coal, 10.
 Townhead, 58, 59.
 — (Cleland), 78, 80.
 Tunnel Fault, 68.
 Turnlaw Reservoir, 7.

 UDDINGSTON, 44.
 — Basin, 4, 9, 43.
 — District, 19-45.
 Udston Colliery, 89, 90, 91, 94, 97, 98.
 Under Kiltongne Coal, 23.
 United Collieries Ltd., 55.
 Unthank Farm bore, 51, 55, 58, 60, 64.
 Upper Coal, 39, 64, 81, 99, 119.

Upper Ell Coal, 18, 64, 81, 99.
 — Drumgray Coal, 16, 23, 50, 74, 90, 108.
 — Limestone Group, 3, 7-11.
 URE, D., 36.

 VIEWPARK COLLIERY, 31, 34, 35, 38, 42.
 Virgin Coal, 17, 20, 29, 32, 58, 79, 94, 113.
 Virtuewell Coal, 17, 20, 26, 76, 84, 92, 110.

 WANDERING COAL, 39.
 "Wants," 18, 32, 53, 59, 83.
 Water supply, 7.
 Waterloo, 116, 118.
 Wee Post Limestone, 8.
 Wellshot Colliery, 16.
 West Quarries, 18.
 Westburn Colliery, 30.
 Westfield bore, 57.
 Whinstone sills, 8, 80, 83.
 — dykes, 44, 70.
 — quarries, 7, 83.
 Whistleberry Colliery, 25, 27, 32, 34, 35, 37, 40, 132.
 — Fault, 43, 44.
 Whitlawburn, 45.
 Wilsontown Main Coal, 10.
 Wishaw, 3, 103, 114, 118.
 — district, 103-123.
 — Quarry bore, 107.
 Woodhall Colliery, 49, 52, 54, 60, 63.
 — Estate bore, 11.

Office—33 George Square, Edinburgh.

The original Geological Survey of the Scottish Coalfields was begun in 1854 and completed in 1890. The maps are published on Ordnance Sheets of the Old Series, each containing twenty-four square miles, hand-coloured, with engraved lines, showing both solid and drift geology.

Geological maps of the Scottish Coalfields on the scale of one inch to one mile are also published, hand-coloured (except where now replaced by the New Series of colour-printed maps on the same scale).

Brief memoirs explanatory of the one-inch geological maps are also on sale with the exception of 12, 30, 39 (not published), and 22, 23 (out of print).

For details of prices see List of Memoirs, Maps and Sections, etc., published by the Geological Surveys of Great Britain and Ireland, to be obtained from the Ordnance Survey or from Agents for the sale of Ordnance maps. Price 6d.

Revision of the coalfields was begun in 1902 and is in progress. The results are being published in Memoirs, Maps on the scale of one inch to one mile (colour printed) and New Series maps on the scale of six inches to one mile, uncoloured, with geological lines and symbols engraved, or hand-coloured to show either solid geology only, or solid and drift geology.

The New Series maps on the scale of six inches to one mile are issued as quarter sheets each containing six square miles. The sheets of the New Series correspond with the sheets of the Old Series except in Edinburghshire, Haddingtonshire, and part of Dumbartonshire. For example, Edinburgh 2 Old Series is now included in parts of 1, 3 and 4 New Series. There has also been some rearrangement of county boundaries. In Ayrshire, Lanarkshire, Renfrewshire, Stirlingshire and Linlithgowshire the Old Series sheets and the New Series correspond. For example, Lanarkshire 8 is still issued as Lanarkshire 8, but in four quarter sheets, 8 N.W., N.E., S.W., S.E.

The publication of the New Series six-inch geological maps has been delayed through circumstances arising from the war. Manuscript copies of maps revised, but not yet published, can be inspected at the Office of the Geological Survey, 33 George Square, Edinburgh. Manuscript copies of such maps, or of parts of them if desired, may be obtained at the cost of the draughtsmen's work entailed, *plus* the cost of the Ordnance Sheet. Information and estimates will be supplied on application to the Superintendent of Maps, H. M. Geological Survey, 33 George Square, Edinburgh.

MEMOIRS.

The Geology of the Glasgow District (1911). Price 4s. 6d.

Explanation of One-inch Sheet 31 (1879). Price 2s. 3d.

The Oil Shales of the Lothians (2nd edition) (1912). Price 2s. 6d.

Geology of the Neighbourhood of Edinburgh (1910). Price 7s. 6d.

Geology of East Lothian (1910). Price 4s. 6d.

Economic Geology of the Central Coalfield of Scotland.

Area V. (Glasgow East, Chryston, Glenboig and Airdrie) 1916. Price 4s. 6d.

Area VIII. (East Kilbride and Quarter) (1917). Price 2s.

Area II. (Plean and Denny, Falkirk, Carron, Grangemouth and Slamannan) (1917).

Price 4s. 6d.

Area IV. (Paisley, Johnstone, Glasgow—South and North of the Clyde). In the Press.

Area VII. (Rutherglen, Hamilton and Wishaw) (1920. Price 7s. 6d.

Other parts in preparation.

Special Reports on the Mineral Resources of Great Britain. The Iron Ores of Scotland
(1920). Price 10s.

Sheet 32.—Edinburgh district (1910). Price 2s. 6d.

Sheet 33.—East Lothian district (1910). Price 2s. 6d.

Sheet 31.—Linlithgow to Glasgow (Engraving).

Special Sheet of the Glasgow District (1911). Price 2s.

		Hand Coloured.	Un-Solid.	Drift.	Un-cold.			Hand Coloured.	Un-Solid.	Drift.	Un-cold.								
		s. d.	s. d.	s. d.	s. d.			s. d.	s. d.	s. d.	s. d.								
Lanark	1 N.W.	Included				Lanark	1 S.E.	3	9	3	9								
		32 N.E.	Included				2 N.W.	Included											
	1 N.E.	Included						33 N.W.											
		32 N.E. and 33 N.W.					2 N.E.	Included											
	1 S.W.	3	9	3	9	1	6						2 S.W.	3	9	3	9	1	6

		Hand Coloured.			Un-
		Solid.	Drift.	cold.	
		s. d.	s. d.	s. d.	
Lanark	2 S.E.	3	9	3	1 6
	3 N.W.	Included in Stirling			
		34 N.W., N.E.			
	3 N.E.	Included in Stirling			
		34 N.E. and 35 N.W.			
	*3 S.W.	Revised, not yet published.			
	3 S.E.	3	9	3	1 6
	4 S.W.	Included in Stirling			
		35 S.W., S.E.			
	*5 N.E.	Revised, not yet published.			
	*5 S.E.				
	6 N.W.	4	3	4	1 6
	6 N.E.	3	9	3	1 6
	6 S.W.	3	9	3	1 6
	6 S.E.	4	3	4	1 6
	7 N.W.	4	3	3	1 6
	7 N.E.	4	3	4	1 6
	7 S.W.	3	9	3	1 6
	7 S.E.	4	3	3	1 6
	8 N.W.	3	9	3	1 6
	8 N.E.	4	3	3	1 6
	*8 S.W.	Revised, not yet published.			
	*8 S.E.				
	*9 N.W.				
	*9 N.E.				
	*9 S.W.				
	*9 S.E.				
	10 N.W.	4	3	4	1 6
	10 N.E.	5	0	4	1 6
	11 N.W.	4	3	3	1 6
	*11 N.E.	Revised, not yet published.			
	11 S.W.	4	3	3	1 6
	*11 S.E.	Revised, not yet published.			
	*12 N.W.				
	*12 N.E.				
	*12 S.W.				
	*12 S.E.				
	*13 N.W.				
	*13 N.E.				
	*13 S.W.				
	*13 S.E.				
	*14 S.W.				
	*14 S.E. (& N.E.)				
	*16 N.E.				
	*16 S.E.				
	*17 N.W.				
	*17 N.E.				
	*17 S.W.				
	*17 S.E.				
	*18 N.W.				
	*18 N.E.				
	*18 S.W.				
	*18 S.E.				
	*19 N.W.				
	*19 N.E.				
	*19 S.E.				
	*20 N.W.				
	*20 N.E.				
	*20 S.W.				
	*20 S.E.				
	*23 N.E.				
	*23 S.E.				
	*24 N.W.				
	*24 N.E.				
	*24 S.W.				
	*24 S.E.	Revised, not yet published.			
	*25 S.W.				
	25 S.E.	Included " in Linlithgow 1 N.W.			
	27 S.E.	3	9	3	1 6
	*28 N.E.	Revised, not yet published.			
	28 S.W.	3	9	3	1 6
	*28 S.E.	Revised, not yet published.			
	"				
	*29 N.W.				
	*29 N.E.				
	*29 S.W.				
	29 S.E.	4	3	3	1 6
	*30 N.W.	Revised, not yet published.			
	*30 N.E.				
	*30 S.W.				
	*30 S.E.				
	*31 N.W.				
	31 N.E.	Included in Linlithgow 1 S.W. and 5 N.W.			
	*31 S.W.	Revised, not yet published.			
	31 S.E.	Included in Linlithgow 5 N.W.			
	*32 N.W.	Revised, not yet published.			
	32 N.E.	3	9	4	1 6
	33 N.W.	4	3	4	1 6
	*33 N.E.	Revised, not yet published.			
	33 S.W.	Included in Lanark 2 S.W.			
	*34 N.W.	Revised, not yet published.			
	34 N.E.	4	3	3	1 6
	*35 N.W.	Revised, not yet published.			
	*35 N.E.				
	*35 S.W.				
	*35 S.E.				
	*36 N.W.				
Stirling		Hand Coloured.			Un-
		Solid.	Drift.	cold.	
		s. d.	s. d.	s. d.	
Stirling	24 N.W.	3	9	3	1 6
	24 N.E.	3	0	3	1 6
	24 S.W.	4	3	3	1 6
	*24 S.E.	Revised, not yet published.			
	*25 S.W.				
	25 S.E.	Included " in Linlithgow 1 N.W.			
	27 S.E.	3	9	3	1 6
	*28 N.E.	Revised, not yet published.			
	28 S.W.	3	9	3	1 6
	*28 S.E.	Revised, not yet published.			
	"				
	*29 N.W.				
	*29 N.E.				
	*29 S.W.				
	29 S.E.	4	3	3	1 6
	*30 N.W.	Revised, not yet published.			
	*30 N.E.				
	*30 S.W.				
	*30 S.E.				
	*31 N.W.				
	31 N.E.	Included in Linlithgow 1 S.W. and 5 N.W.			
	*31 S.W.	Revised, not yet published.			
	31 S.E.	Included in Linlithgow 5 N.W.			
	*32 N.W.	Revised, not yet published.			
	32 N.E.	3	9	4	1 6
	33 N.W.	4	3	4	1 6
	*33 N.E.	Revised, not yet published.			
	33 S.W.	Included in Lanark 2 S.W.			
	*34 N.W.	Revised, not yet published.			
	34 N.E.	4	3	3	1 6
	*35 N.W.	Revised, not yet published.			
	*35 N.E.				
	*35 S.W.				
	*35 S.E.				
	*36 N.W.				
Linlithgow		Hand Coloured.			Un-
		Solid.	Drift.	cold.	
		s. d.	s. d.	s. d.	
Linlithgow	1 N.W.	2	0	2	1 6
	1 N.E.	3	0	3	1 6
	1 S.W.	4	3	3	1 6
	1 S.E.	4	3	3	1 6
	2 N.W.	3	9	3	1 6
	(S.W.)				
	2 S.E.	3	0	3	1 6
	3 S.W.	3	9	3	1 6
	*3 S.W.	Revised, not yet published.			
	(2nd ed.)				
	4 S.E.	Included in Stirling 35 N.E. and 36 N.W.			
	*5 N.W.	Revised, not yet published.			
	*5 N.E.				
	*5 S.W.				
	*5 S.E.				
	6 N.W.	3	0	3	1 6
	6 N.E.	3	9	3	1 6
	6 S.W.	3	9	3	1 6
	6 S.E.	3	0	3	1 6
	7 N.W.	3	9	3	1 6
	(S.W.)				
	*7 N.W.	Revised, not yet published.			
	(S.W.)				
	(2nd ed.)				

* Copies can be supplied in manuscript.

		Hand Coloured. Un-Solid. Drift. cold.							Hand Coloured. Un-Solid. Drift. cold.					
		s. d.	s. d.	s. d.	s. d.	s. d.			s. d.	s. d.	s. d.	s. d.		
Linlithgow	7 N.E.	Partly included in Edinburgh 1 S.W. and 2 N.E.					Ayr	*7 S.E.	Revised, not yet published.					
	8 N.W.	Included in Stirling 35 S.E. and Lanark 9 N.W.							"					
	*8 N.E.	Revised, not yet published.							"					
	8 S.W.	Included in Lanark 9 N.W., N.E.							"					
	*8 S.E.	Revised, not yet published.							"					
	*9 N.W.								"					
	9 N.E.	4	3	4	3	1 6			"					
	*9 N.E.	Revised, not yet published.							"					
	*9 S.W.								"					
	9 S.E.	3	9	3	9	1 6			"					
	*9 S.E.	Revised, not yet published.							"					
	10 N.W.	3	0	3	0	1 6			"					
	*10 N.W.	Revised, not yet published.							"					
	10 S.W.	3	9	3	9	1 6			"					
	*10 S.W.	Revised, not yet published.							"					
	*11 N.E.	Revised, not yet published.							"					
	*11 S.E.	"							"					
	*12 N.W.	"							"					
	12 N.E.	3	9	3	9	1 6			"					
	*12 S.W.	Revised, not yet published.							"					
Renfrew	*7 N.E.	"					Edinburgh	1 S.W. } 1 B S.E. }	2	3	2	3	1 6	
	*7 S.E.	"							1 S.E.	2	3	2	3	1 6
	*8 N.W.	"							3 N.W.	3	9	3	9	1 6
	*8 N.E.	"							3 N.E.	4	3	4	3	1 6
	*8 S.W.	"							3 S.W.	3	9	3	9	1 6
	*8 S.E.	"							3 S.E.	4	3	4	3	1 6
	9 N.W.	Included in Dum-barton 25 N.E.							4 N.W.	3	9	3	9	1 6
	(* S.W.)								4 N.E.	2	3	2	3	1 6
	*11 N.E.	Revised, not yet published.							4 S.W.	4	3	4	3	1 6
	*11 S.E.	"							4 S.E.	4	3	4	3	1 6
	*12 N.W.	"							4A S.W.	2	3	2	3	1 6
	12 N.E.	4	3	4	3	1 6			5 N.E.	3	0	3	0	1 6
	*12 S.W.	Revised, not yet published.							5 S.E.	4	3	3	0	1 6
	12 S.E.	4	3	4	3	1 6			7 N.E.	4	3	4	6	1 6
	13 N.W.	Included in Lanark 6 S.W. and 10 N.W.							7 S.E.	4	3	4	3	1 6
	13 N.E.	Included in Lanark 10 N.E.							8 N.W.	4	3	4	3	1 6
	13 S.W.	4	3	4	3	1 6			8 N.E.	4	3	4	3	1 6
	*13 S.E.	Revised, not yet published.							8 S.W.	6	3	6	3	1 6
	14 S.E.	Included in Ayr 8 N.W.							8 S.E.	4	3	4	3	1 6
	*15 N.W.	Revised, not yet published.							9 N.W. & 3	0	3	9	1 6	
15 N.E.	Partly included in Ayr 9 N.W.					Haddington								
15 S.W.	Included in Ayr 8 N.W.					14 N.W.								
15 S.E.	Included in Ayr 8 N.E. and 9 N.W.					9 S.W. & 3								
*16 N.W.	Revised, not yet published.					Haddington								
*16 N.E.	Revised, not yet published.					14 S.W.								
Dumbarton	*23 S.W.	Revised, not yet published.					9 S.E.							
	23 S.E.	3	9	3	9	1 6	*10 N.E.							
	25 N.E.	4	3	4	3	1 6	Revised, not yet published.							
							"							
								*10 S.W.						
									"					
									"					
									"					
									"					
									"					
									"					
									"					
									"					
									"					
									"					
									"					
									"					
									"					
									"					
									"					
									"					
									"					
									"					
									"					
							"							
							"							
							"							
							"							
							"							
							"							
							"							
							"							
							"							
							"							
							"							
							"							
							"							
							"							
							"							
							"							
							"							
							"							
							"							
							"							
							"							
							"							
							"							
							"							
							"							
							"							
							"							
							"							
							"							
							"							
							"							
							"							
							"							
							"							
							"							
							"							
							"							
							"							
							"							
							"							
							"							
							"							
							"							
							"							
							"							
							"							
							"							
							"							
							"							
							"							
							"							
							"							
							"							
							"							
							"							
							"							
							"							
							"							
							"							
							"							
							"							
							"							
							"							
							"							
							"							
							"							

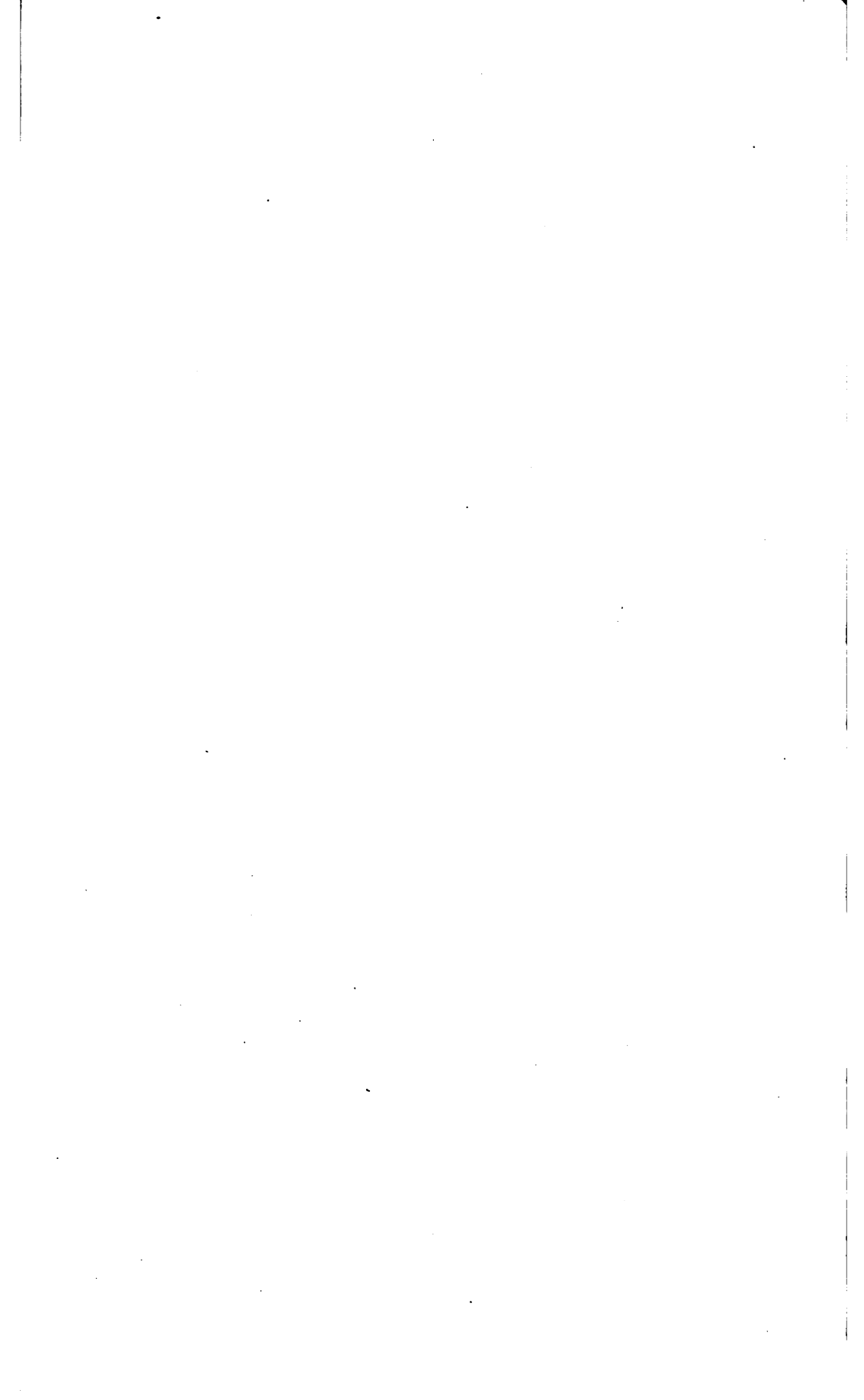
		Hand Coloured.			Un-			Hand Coloured.			Un-			
		Solid.	Drift.	s. d.	cold.			Solid.	Drift.	s. d.	cold.			
		s. d.	s. d.	s. d.	s. d.			s. d.	s. d.	s. d.	s. d.			
Edinburgh	18 N.E.	1	9	1	9	1	6	Haddington 14 N.W.	See Edinburgh 9			N.W.		
	19 N.W.	2	3	2	3	1	6							
	19 N.E.	3	0	3	0	1	6							
Haddington	4 S.W.	1	9	—	—	1	6	14 N.E.	3	9	3	0	1	6
	4 S.E.	3	9	3	9	1	6	14 S.W.	See Edinburgh 9			S.W.		
	9 N.W.	3	9	3	9	1	6	14 S.E.	See Edinburgh 9					
	9 N.E.	3	0	3	0	1	6	18 N.W.	See Edinburgh					
	9 S.W.	See Edinburgh 4 ^A						15 N.W.						
	S.W.													
	9 S.E.	3	0	2	3	1	6							

VERTICAL SECTIONS.

On scale of 1 in. = 40 ft. Price 1s. 8d. each.

1. Edinburghshire and Haddingtonshire Coalfields (1863).
- 1A. Midlothian Coal Basin (middle portion) (1909).
- 1B. " " (western side) (1909).
- 1C. " " (western side) (1909).
- 1D. " " (eastern side) (1909).
- 1E. East Lothian Coal Basin (1909).
2. Fifeshire Coalfields (1889).
- 2A. " " (1904).
3. Kilmarnock and Hurlford Coalfield (1870).
4. Clyde Basin Coalfields (1874).
5. Stirlingshire and Clackmannanshire Coalfields (1877).
6. Muirkirk, Glenbuck, Lesmahagow, Douglas and Ponfeigh Coalfields (1879).
7. Clyde Valley Coalfield between Rutherglen and Carluke (1879).

For further particulars see *List of Memoirs, Maps, Sections, etc.*, published by the Geological Surveys of Great Britain and Ireland, to be obtained from the Ordnance Survey or from Agents for the sale of Ordnance maps. Price 6d.





YC 18822

416453

Clough

TIN 808

G 6C48

UNIVERSITY OF CALIFORNIA LIBRARY

